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THE

MECHANICS' MAGAZINE,

AND

JOURNAL OF ENGINEERING, AGRICULTURAL MACHINERY, MANUFACTURES, AND SHIPBUILDING.

V. c 71

VOL. II.

(NEW SERIES.)

JULY TO DECEMBER, 1859.

EDITED BY

R. A. BROOMAN AND E. J. REED.

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"Man is a tool-using animal. Weak in himself, and of small stature, he stands on a basis, at most for the flattest soled, of some half square-foot, insecurely enough; has to straddle out his legs, lest the very wind supplant him. Feeblest of bipeds! Three quintals are a crushing load for him; the steer of the meadow tosses him aloft, like a waste rag. Nevertheless he can use tools, can devise tools: with these the granite mountain melts into light dust before him; he kneads glowing iron, as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds. Nowhere do you find him without tools; without tools he is nothing, with tools he is all."—CARLYLE.

"Every structure or machine, whose design evinces the guidance of science, is to be regarded not merely as an instrument for promoting convenience and profit, but as a monument and testimony that those who planned and made it had studied the laws of nature: and this renders it an object of interest and value, how small soever its bulk, how common soever its material. . . . . The engineer or mechanic, who plans and works with understanding of the natural laws that regulate the results of his operations, rises to the dignity of a sage."—PROFESSOR RANKINE.

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PREFACE.

IN placing the Second Volume of our New Series before our readers we avail ourselves of the opportunity which a Preface affords for offering a few remarks that cannot well find a place elsewhere.

We would first express our thanks for the firmness with which men of scientific tastes and pursuits continue to support, in its new form, this Magazine, which other pens than ours made popular many years ago. A thousand things have shown us during the past year that those old friends who long looked upon this journal with even more than a friendly interest, have not had their regards alienated by either the external or the internal changes which it has of late undergone. We have likewise had many proofs of the support which new friends are in various ways according us. By all these manifestations of good feeling we are delighted, and for them we are grateful.

Many subjects of great importance have engaged our attention during the half-year which now expires. Among the earliest of them was that Admiralty Committee on Dockyard Economy, upon which some thousands of pounds of public money were squandered, and which did its best to effect changes involving the squandering of many thousands more. We have good reason to believe that our simple explanations on this subject have left the Committee but little hope of accomplishing its designs. The Coinage of the Realm is another subject that has been discussed with manifest effect in our columns. The manufacture of the new bronze coinage, now in course of preparation, is an acknowledged concession to our representations and efforts. In the present activity of the War Department and the Admiralty in reference to Rifled Ordnance we believe we see a consequence of our urgent remonstrances, followed up as they were by the speeches of that veteran patriot, Lord Lyndhurst, in the House of Peers. The Great Eastern has occupied much of our attention, not altogether, we trust, without effect. It was not possible to speak of her in terms that would be pleasant to all parties, because, as a commercial speculation, she has excited an immense amount of partizanship; moreover, since the memorable explosion which we had the pain of witnessing on her first sea trip, she has been continuously enveloped in a blaze of raging controversy. Happily we have had no interest in her to blind us, and no antipathies to colour what we have seen; so that we have been able to offer unprejudiced and fearless criticisms on this subject, which have not, as we are often assured, been valueless. The abuse of the British Association—by which it was rendered a medium "for advertising inventions" rather than for advancing science—to which we, and we only, drew attention in October last, will in future, we are informed, be guarded against. The Royal Navy, to which we give much attention, and with which we claim a real although humble association, was never in a more prosperous or more efficient condition than it is at present. The movement made by the French in respect of iron-coated ships has been met in a most spirited manner by our Admiralty, and the remonstrances which we publicly made on this subject in May last have been followed by the issue of contracts for no less than *four* iron-defended ships for Her Majesty's Navy—all of them vessels which promise to be of unparelleled power and invulnerability. Our articles on the Theory of Ship-building and Laying-off have been slowly but steadily and carefully proceeded with, and will be continued until they become complete. In reference to Naval Architecture generally we have not been inactive, as is evidenced by the hostility which certain amateur writers on this subject are evincing towards us. The complaint of these gentlemen is, not that we do not understand naval architecture, or that we are devoid of the ability to express ourselves clearly in a literary sense, but that we have too much confidence in ourselves—too little respect for others—for *them* they mean, of course. We can only say we hope this is not so; we shall certainly not believe it is until *competent* judges express the opinion. We will leave this subject by promising to all who are concerned in it—friends and "unfriends"—an interesting novelty, which will come before them, we doubt not, before we pen another preface—a novelty that will gladden the hearts of all true lovers of the noble art of shipbuilding. We must not say more just at present.

But we have said enough in this egotistical strain, and will therefore end here—end with the hope that, notwithstanding the proud burst of new literature with which the year 1860 is opening, our voice will still be waited for with interest, and listened to with attention.

THE EDITORS.

December, 1859.

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1859

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 1, 1859.

OUR COPPER COINAGE.

THE Mint, we learn, is engaged at present in the production of copper coin, of which it is said there exists in many parts of the kingdom a complete dearth. The ebbings and flowings of the copper currency have always been, indeed, perplexing to the authorities of the Mint. There appear to be eddies in the tide of its circulation which are not easily understood, or to be accounted for. Sometimes there is a drifting of pence, halfpence, and farthings to Manchester, then to Glasgow, and next perhaps to Birmingham, or London. Then, again, in particular districts of particular towns, there are strange accumulations and scarcities. For example, there is always a natural current of copper coin towards the East-end of the metropolis. It is more in request—unfortunately for the dwellers therein—in Bethnal-green than in Belgravia, and the supply inevitably follows the demand. A sort of trade wind floats the copper currency through the channels of circulation in this direction, as surely as the literal trade wind wafts commercial argosies across the ocean. These irregularities cannot be avoided, but the Mint is being constantly called upon to correct them, and it can clearly only do so by adding to the quantity of coin in circulation. There are also peculiar businesses which lead to the congregation of copper tokens, and it is a well-known fact that the publican usually pays his brewer's bill with them. It is well to explain these facts perhaps to the public, in order that the whole question of the metallic currency may be comprehended with a view to its ultimate reform. There may be about £800,000 worth of the various denominations of copper coin in existence in Great Britain, and as has been said there is an ever-recurring tendency to an unequal and eccentric distribution of it.

The history of the farthing especially is strange and obscure. It disappears in larger quantities than its bigger brethren and sooner. Yet it has a less active life. It is not popular with a large class of tradesmen. It is beneath their notice, not convenient and unprofitable; hence it is banished from their society. It is an outcast coin only used by pawnbrokers and their victims—we mean customers—chandler's, shopkeepers, and costermongers. In the lowest class of shops in the lowest neighbourhoods, and among the lowliest people only, does the farthing enjoy a brisk circulation. Children hoard farthings, and misers take care of them, but the public generally eschew them. It is with difficulty that the poor farthing, therefore, maintains its ground at all. Possibly, if the sun of England's greatness has not yet reached its zenith, the farthing may some day be swept away in the flood-tide of national prosperity and disappear entirely. At any rate, there is not much prospect of a resuscitation of the half-farthing. This, and the quarter-farthing, and the *oboli*, or tenth of a penny, may be, and are, of use in Ceylon and the Ionian Islands, but they are too small for the notice of the inhabitants of *Great* Britain, and we trust may ever remain so.

It will be permitted us again to express a hope that in the meditated new bronze coinage we may find an artistically and scientifically perfect substitute for the copper coinage now under doom, and which has been the fruitful source of so much justly severe criticism, and so much practical inconvenience. Whether it may be possible also to contrive some means of keeping it in equable and healthy circulation, without the evils of local plethora and local famine being experienced, is a question worthy consideration also. Having opened the agitation on the general improvement of the British coinage, it is our intention not to allow it to be closed until that improvement is effected. The importance of the subject does not brook apathy or indifference. It signifies not that Lord Overstone has put *his* veto on any and every decimal system ventilated before the Commission, whose "final report" on the whole subject of decimal coinage is now printed. There is an admitted—a generally admitted—necessity for a reformation of our inferior metallic currency, and that reformation, of which we see in the forthcoming bronze halfpenny the beginning, must soon be made complete and satisfactory.

NEW SUBMARINE TELEGRAPH CABLES.

AMONG the many novelties which have lately been introduced as improvements in the construction of submarine telegraph cables there is one which for its extreme simplicity and cheapness appears to deserve the special notice of the public. This is the system of construction which was described in the letter of a correspondent in our last number. In this system the resort to india-rubber as the insulating agent, which has lately found great favour among scientific men, is again renewed, and with it is combined a process of external hardening from which very great advantages may be anticipated. This process appears to have originated in certain practical experiments made by the inventor upon a portion of wire like that of the Atlantic telegraph cable. By an ingenious substitution of a potassium wire for the copper wire the permeability to water of a cable so constructed was made very apparent; but further experiment showed that this permeability was got rid of by the simple expedient of immersing the coated wire in bisulphuret of carbon and chloride of sulphur. The same effect is produced by this process upon india-rubber as well as upon gutta-percha. A further advantage attending the process is, that the "cold vulcanizing," as it is called, at the same time renders the india-rubber or gutta-percha capable of sustaining a heat of no less than 250° Farenheit without suffering any injury whatever.

The method of manufacturing the cables upon the improved system is very simple. Successive coatings of india-rubber in a softened state are rolled directly upon the conducting wire by means of powerful pairs of rollers, the pressure of which is sufficient to render the coating substance close and homogeneous. When a sufficient thickness has been laid on in this manner, the cable is passed through the chemical materials before-named, and its surface is thus rendered hard and perfectly non-porous. After this coverings of hemp, wire, gutta-percha, or any other suitable substance may be added if desired to increase the protection of the wire. For many purposes, however, the inventor considers it amply sufficient to incorporate longitudinal fibres of hemp or flax in the outer coating of the india-rubber in order to prevent strain coming upon the conductor, and then to finish the cable with the cold vulcanization.

The inventor of the simple and inexpensive cable is Mr. John Macintosh, of North Bank, Regent's Park, who has had several patents for improvements in submarine cables granted him, and who for twenty years past has had constant experience in the manufacture of india-rubber fabrics. The cost at which he proposes to produce the improved cable is so low in comparison with the cost of existing cables that shareholders will doubtless receive his offers in this respect with astonishment, while the rapidity with which his machinery works is so great that he undertakes to produce no less than 250 or 300 miles of perfect vulcanized cable per day! The full carrying out of his designs would certainly be an enormous stride in submarine telegraphy, for the apparatus required in the manufacture of the cable is so very simple and compact that he proposes placing it, with a supply of plain india-rubber, on board ship, and then making the cable continuously as it is payed out. This method of proceeding is attended by so little trouble and expense that we can scarcely doubt it will speedily be resorted to in the construction and laying down of many of those numerous cables which the exigencies of commerce and war are now daily demanding.

MR. BESSEMER AND THE IRON MANUFACTURE.

THREE years ago Mr. Henry Bessemer thought he had accomplished what has very rarely been done in the world—that is, revolutionized a great manufacture by a single discovery—and was mistaken. This year he has really effected what has often before been brought about—that is, improved a great manufacture by laborious and costly experiment. In the paper which was published in the two preceding numbers of this Magazine he has detailed facts which, while important in a commercial sense, also afford valuable lessons to inventors and others.

In adverting to this paper we are struck by the extraordinary want of candour which Mr. Bessemer appears to us to display. In the first place he implies that the paper read by him at the British Association in 1856, was but a step incidental to his pursuit of an inquiry, rather than an announcement of amazing results then already obtained. "The same deep conviction "of the truth on which the new process was "based, and which led Mr. Bessemer to bring it "before the British Association in 1856, has "since determined him," we are told, "(in spite "of the opinions then pronounced against the "process) to pursue one undeviating course "until the present time, and to remain silent "for years, under the expressed doubts of those "who predicted its failure, rather than again "bring forward the invention until it had been "practically and commercially worked, and "there had been produced by it both iron and "steel, of a quality which could not be surpassed by any iron or steel made by the "tedious and expensive processes now in general "use." This representation is not borne out by facts. Every one will remember that Mr. Bessember spoke at Cheltenham, not of anticipated productions of iron, but of iron which, as was alleged, had actually been manufactured by his new process. In the last paragraph of his paper he distinctly stated this. "In conclusion, "allow me to observe," said he, "that the facts "which I have had the honour of bringing before the meeting have not been elicited from "mere laboratory experiments, but have been "the result of working on a scale nearly twice "as great as is pursued in our largest ironworks, "the experimental apparatus doing 7 cwt. in "30 minutes while the ordinary puddling furnace makes only 4½ cwt. in two hours."

It may suit Mr. Bessemer's present purpose to sink the pretensions which he put forth in 1856; but we cannot forget that the world was then made to believe in a discovery by aid of which iron and steel could at once be produced, without fuel, for the market.

Next we have to expose a further, and equally extraordinary, want of candour manifested in

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the allusions which Mr. Bessemer made in his recent lecture to the difficulties which have opposed the successful application of his invention. He says :—

"The want of success which attended some of the early experiments was erroneously attributed by some persons to the "burning" of the metal, and by others to the absence of cinder, and to the crystalline condition of cast metal. It was almost needless to say that neither of the causes assigned had anything to do with the failure of the process in those cases where failure had occurred. Chemical investigation soon pointed out the real source of difficulty. It was found, that although the metal could be wholly decarbonised, and the silicum be removed, the quantity of sulphur and of phosphorus was but little affected; and as different samples were carefully analysed, it was ascertained that red shortness was always produced by sulphur when present to the extent of one-tenth per cent., and that cold shortness resulted from the presence of a like quantity of phosphorus; it, therefore, became necessary to remove those substances. Steam and pure hydrogen gas were tried, with more or less success, in the removal of sulphur, and various fluxes, composed chiefly of silicates of the oxide of iron and manganese, were brought in contact with the fluid metal, during the process, and the quantity of phosphorus was thereby reduced. Thus many months were consumed in laborious and expensive experiments; consecutive steps in advance were made, and many valuable facts were elicited."

Here we are sneeringly told that neither of the causes assigned by disinterested persons for Mr. Bessemer's failures in 1856 had anything to do with those failures ; and we are further told that the true cause was the presence of sulphur and phosphorus in the metal produced, the air blast having but little effect upon these impurities. But what are the facts? One of the earliest adverse criticisms of Mr. Bessemer's paper which appeared was an article contributed to the MECHANICS' MAGAZINE of September 13, 1856, by Mr. William Truran, the author of an admirable volume on "The Iron Manufacture of Great Britain ;" and in that article the author distinctly pointed out the fact that Mr. Bessemer's process did nothing towards the removal of the sulphur and phosphorus from the metal. "Mr. Bessemer committed a great "mistake," said Mr. Truran, "when he claimed "for his plan the production of that quality "known as charcoal iron, simply from the re-"fining being conducted without contact with "mineral fuel. A superficial acquaintance with "the subject would have shown that the quality "of the fuel used in the manufacture of a "moiety of the bar-iron, *so far as regards the "usual contaminating ingredients, sulphur and "phosphorus*, has nothing to do with the ulti-"mate quality of the bar." And again the same gentleman, in an article which appeared in the MECHANICS' MAGAZINE of the following month, said :—"It is questionable if one single "atom of *phosphorus or sulphur* was separated "[in Mr. Bessemer's experiments], for the re-"sults of analysis are altogether against a more "favourable conclusion. Phosphorus and sul-"phur exist to the extent of 1½ per cent. in "many pig-irons, *and their removal is essentially "necessary to the production of good malleable "iron*." How Mr. Bessemer could have gone on pottering at chemical analyses in order to discover facts which a sound practical iron-maker was thus clearly placing before him, or how he can now have the effrontery to sneer at those who were taking pains to teach him what he was so manifestly ignorant of, we are at a loss to conceive.

But while we may look to Mr. Bessemer in in vain, we fear, for any manly recognition of his own shortcomings, or any grateful acknowledgement of the aid which others offered him, and while we must receive with caution all that he comes forward to say in commendation of his own proceedings, we have no wish to deny that he has at last done good service to the iron manufacture of the world. The specimens of metal produced by his improved processes which were exhibited at the Institution of Civil Engineers on the evening of his late lecture, and subsequently at the President's conversazione, deservedly elicited much praise, and afforded manifest ground for many of the hopeful statements made on the first of these occasions, and published in the abstract lately given in our columns.

It is a most gratifying thing to know that we have now put into our hands a homogeneous malleable metal which may be cast into any desired form, and which leaves the mould free from cracks, flaws, hard veins, &c., and is at the same time of enormous tensile strength. Several samples of the Bessemer steel tested in the proving machine at Woolwich Arsenal bore, according to the reports of Colonel Eardley-Wilmot, R.A., a strain varying from 150,000 lbs. to 162,900 lbs. to the square inch, and four samples of iron boiler plate from 68,314 lbs. to 73,100 lbs. ; while according to the published experiments of Mr. Fairbairn, Staffordshire plates bear only a mean strain of 45,000 lbs., and Low Moor and Bowling plates a mean of 57,120 lbs. per square inch. There is also another fact of great importance, as we are reminded, in a commercial point of view. In the manufacture of plates for boilers and for ship-building the cost of production increases considerably with the increase of weight in the plate ; for instance, the Low Moor Iron Company demand £22 per ton for plates weighing 2½ cwt. each ; but if the weight exceeded 5 cwt. then the price rises from £22 to £37 per ton. Now, with cast ingots such as the one exhibited at the Institution by Mr. Bessemer, and from which the sample plates were made, it was less troublesome, less expensive, and less wasteful of material, to make plates weighing from 10 to 20 cwts. than to produce smaller ones ; and, indeed, there was but little doubt that large plates would eventually be made in preference, and that those who wanted small plates would have to cut them from the large ones. A moment's reflection therefore shows the great economy of the new process in this respect ; and when it is remembered that every riveted joint in a plate reduces the ultimate strength of each 100 lbs. to 70 lbs., the great value of long plates for girders and for ship-building will be fully appreciated.

Nor can we leave this subject without referring, at the risk of repetition, to the wonderful promises which the Bessemer process holds out to us in reference to the manufacture of ordnance. Many attempts have been made to produce wrought-iron ordnance, and this object has been successfully accomplished in the case the large gun produced at the Mersey forge. But, however perfect this one gun may be, the time required to make it, and its immense cost, manifestly render it still, as Mr. Bessemer stated, a great desideratum to produce guns rapidly and cheaply, of a material equal to, or greater in tensile strength than wrought-iron, and, if possible, free from the liability which that material has to flaws and to deterioration during long exposure to a welding heat. It is believed that the Bessemer process supplies this desideratum, as masses of cast malleable metal can be produced of ten or twenty tons in weight in a single piece, and two or three such pieces may be conveniently made by the same apparatus in one day. The metal so made may be either soft malleable iron, or soft steel. In order to prove the extreme toughness of such iron, and the strain to which it may be subjected without bursting, several cast and hammered cylinders were placed cold under the steam hammer, and crushed without the least tearing of the metal. These cylinders were drawn from a round cast-iron ingot of only two inches greater diameter than the finished cylinder, and in the precise way in which a gun would be treated ; they may, therefore, be considered as short sections of an ordinary 9-pounder field-piece. The tensile strength of the samples, as tested at the Royal Arsenal, was 64,566 lbs. per square inch ; while the tensile strength of pieces cut from the Mersey gun gave a mean of 17,550 lbs. longitudinally, and 43,339 lbs. across the grain ; thus showing a mean of 17,550 lbs., per square inch in favour of the Bessemer iron. For the accuracy of these figures Mr. Bessemer is responsible. If it is desired to produce ordnance by merely casting the metal, the ordinary founding process may be employed, with the simple difference that the iron, instead of running direct from the melting furnace into the mould must first be run into the converting vessel, where in ten minutes it will become steel or malleable iron, and the casting may then take place in the ordinary manner. Conical masses of this pure tough metal, of from 5 to 10 tons in weight, can be produced at Woolwich at a cost not exceeding £6 12s. per ton, inclusive of the cost of pig iron, carriage, remelting, waste in the process, labour, and engine-power. These important facts have been laid, we are told, before the Government, and their advantages are stated to be fully appreciated by Colonel Eardley-Wilmot, the Superintendent of the Royal Gun Factories, who has evinced a great interest in the progress of the invention from its earliest date.

EXPLOSIONS AT GUNPOWDER WORKS.

IT is desirable, we think, before the memory of the late fatal explosions at Hounslow passes entirely from the public mind, to recur once more to certain important considerations suggested by them. In doing this we will, in the first place, revert to the evidence given before the Coroner in reference to the late inquiry, confining ourselves to the last sitting of the jury. The following are extracts from that evidence :—

"Mr. Rowse stated that he was about 90 yards off at the time. It was the lower press exploded first. Could not say whether the treble dust was brought into the press-house over night, or whether more in the morning was taken in a boat ; could not say how much there was on the premises the day before. The pressure is taken off by letting the water off directly. The powder was pressed enough. Takes about five minutes to move the powder from the press. Cannot remember how much in the press-house the night before. Might have been fifty barrels. Could not state there was not eight hundred barrels made per week on the premises.

"Mr. Ashby, the manager of the works : Had not any farther information to give as to the cause of the accident. Was now constructing the press in a very different manner with transverse arches, bomb-proof, with 20 feet of earth over. This wall or fence to be between the press-house and the place where the men would work the pumps for the hydraulic pressure. The new press to carry eight barrels instead of double that quantity, as was the case in the late press. There was a Government inspection by two military officers to ascertain the quality of the powder making for Government contracts. The firm had existed 30 years. The mills had been in existence one hundred years. Should not have a water-tank over the new press-house. Considered it caused the great lateral explosion. It was his decided opinion explosions were unavoidable. Had increased the number of mills on the premises by five in the last fifteen years. Had sworn that 400 barrels on an average was the quantity made on the premises at Twickenham per week. Had no reason from subsequent inquiry or other means to alter that statement. Would not swear there was not eight hundred barrels per week made on the premises. In the corning-house, which exploded after the press-house, there were three men employed. The quantity of powder usually there was from ten to fourteen barrels. In the green charge,

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or what was now called incorporating houses, forty-two pounds of powder only at a time; forty pounds being allowed by Act of Parliament, and two pounds for waste. In the glazing-house there are about twenty barrels at a time. One-third of the powder glazed at Twickenham works came from the Bedford Mills.

"Henry Atlee: Is a glazing man. Had been much injured. There were one hundred barrels of powder in the glazing-house at the time of explosion; sometimes there are as many as three or four hundred barrels, sometimes only twenty. On the day before the explosion he was in the press-house; saw two hundred barrels there. Forty-nine barrels had been removed from the corning-house to the glazing-house during the morning previous to the explosion. Had no instructions as to quantity of powder to be in the glazing-house at once. Glazed one hundred and thirty barrels a day in both houses. Three men employed. Sometimes glazed more, sometimes less. That was the quantity expected to be done. Worked on Sundays as on other days. Quantity of powder taken into the green charge or incorporating-house was a hundred-weight at a time. Should return to the mills when sufficiently recovered."

We make no reference here to the evidence of Mr. Taylor, the former engineer to the works, —who left, by his own admission, from his "conviction that the several alterations at the "works were of a most dangerous description" —because that evidence, given without solicitation to many persons *ex judicio*, does not appear to us to agree with that rendered by him before the Coroner. We will therefore leave Mr. Taylor out of our future comments, merely reproducing a remark openly made in court, that "Mr. Taylor's evidence would appear to "have been more valuable out of doors than "in." It may appear strange that the important portions of the inquiry, as given above, should differ so widely from the accounts which appeared in most of the daily and other journals. Our notes were, however, taken by an especial hand, and we have great reason to confide in their integrity and truthfulness.

It will have been already observed that while Rowse could not swear there were not 800 barrels made per week, Ashby states there were but 400, but would not say there were not 800, and Atlee gives the quantity glazed as 130 barrels per day—equal, as the work is carried on upon Sunday, to 910 barrels per week! Mr. Ashby further states that the greatest quantity kept in the corning-house was from ten to fourteen barrels. Atlee tells us that forty-nine barrels had been moved to the glazing-house from the corning-house during the morning of the explosion. Mr. Ashby further states that forty-two pounds was the quantity allowed in the incorporating-houses, according to Act of Parliament, and we are left for the moment to infer that the Act has not been treated with contempt. But Atlee steps into the last witness's place, and testifies to the fact that one hundredweight at a time was taken into the incorporating-houses!

Can anything be more lamentable than such a perversion of truth? for either these men are asserting what they know to be contrary to fact, or two out of three of them are apparently ignorant of the most important details of their duties, and consequently totally unfit for the responsible situations they hold. If Atlee is right, what an additional burlesque have we here upon "the solemn commands of "the Legislature." Driving a coach and six through an Act of Parliament is fairly outdone where a hundredweight of gunpowder can so easily blow it to the winds. Will so clear a violation of the law as is here shown be permitted to pass unnoticed by the authorities?

We elicit from the evidence the fact that although there exists no official inspector of gunpowder works, there are two persons deputed to inspect and test the strength of the powder making for the Government. Their offices must be a sinecure—perhaps placed under some comfortable arrangement which makes "things right"—or we should not have had to allude to the contumely with which a Government Inspector was treated upon demanding admittance at the gates of the works the day after the late accident, and whose person was not even known to the man who had held the post of porter for many years.

Mr. Ashby's statement that the proprietors of the works had determined upon constructing the press in a different manner to carry eight instead of sixteen barrels, is a tacit admission that his own judgment is at variance with that of his employers. We are still disposed to think that even the raising of the mound "upon transverse arches and rendering "it bomb-proof" will not afford sufficient protection for the men, unless the conditions of the Act of Parliament and the *presumed* regulations as to the prescribed quantity of powder to be admitted under the roof at one time be strictly adhered to—bomb-proof not being necessarily gunpowder proof. Mr. Ashby's "de-"cided impression that explosions are unavoid-"able" we consider a most important and injurious admission, since it partly discredits attempts to mitigate or suppress these calamities; and in the very front of so bold and mischievous an assertion we have lately had in our own columns the testimony of one of the largest firms for the manufacture of gunpowder in the world, where, as a consequence of judicious forethought, and the adoption of "very "many improvements," a fatal accident has not occurred for twenty-five years. This dogged refusal to adopt remedies for the prevention of the sacrifice of "hands"—for such is the conventional term now applied to working men —is not confined to gunpowder works; but happily it does not, through the merciful interference of the Legislature, exist to the same extent as it did a few years ago. Perhaps the Government will ere long see in the manufacture of gunpowder a reason for some change; and as the conditions of one of its Acts has already been grossly violated, it needs no extraordinary excuse for an immediate and searching inquiry.

We have heard it advanced as a *non sequitur* to the suggestion that these mills should be removed farther from the presence of large communities, that the communities came to the neighbourhood of the works and not the works to the communities. Now this is partly true and partly false. One set of mills may have existed one hundred years, but we doubt whether the other two sets, some mile or two apart, have been established one-half that time. And in addition to this question of dates—if there really be anything in it—we maintain that it is only within the last few years that by the presence of steam and of huge furnaces, and of the increased number of mills which are admitted to exist by Mr. Ashby, and which several tall shafts of modern construction fully identify, these works have become so formidable and alarming. If, in a word, we are thus far correct, there is not a habitation that has been built fifteen or twenty years, or even less, but what had a *locus standi* prior to the formation of the *bona fide* works as they now exist, and not an inhabitant of such dwellings but what would have a just cause for action if there be any virtue in the old notion of the penalty attached to the formation of a novel nuisance.

THE ROYAL POLYTECHNIC.

IT is with the deepest regret we learn the impending close of the above popular Institution. The expenses connected with the accident which occurred in January last to the spiral staircase has effectually crippled, as we lately intimated, the resources of the directors. The costly litigation of actions on the part of some of the sufferers, and the liberal discharge of a fair and humane consideration of the claims of others, have exhausted the means at the disposal of the directors, and nothing remains but the sale of the premises and their really valuable contents by public auction. This effort having failed, the Institution must be sacrificed, unless another company can be formed to save it from destruction. This, notwithstanding the information which we lately published upon this subject, has not, it now appears, been accomplished. It would be a lasting discredit alike to the scientific taste and moral tone of London if such an Institution should be suffered to cease for want of the few thousand pounds which would at once reinstate it in its position among the unobjectionable and popular Lions of the Metropolis.

On public grounds we venture to press the case of the Polytechnic upon the serious and immediate consideration of public philanthropists. No time is to be lost. A few days will either consign the noble premises to mercantile ends, if not to objectionable purposes still more at variance with the design of the Institution, unless the scientific and religious public interpose their co-operation to restore it to its wonted uses.

THE CASE OF HENRY CORT, AND HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

No. IV.

THE specifications recently published by Mr. Woodcroft, under the authority of the Commissioners of Patents, show that the inventive genius of the country was directed principally, during the first half of the 18th century, to the addition of materials and ingredients, and the adoption of fluxes for facilitating the melting and improving the quality of iron.

In 1728 a patent was granted to John Payne for machinery for obtaining motive power by atmospheric pressure; for improved furnaces and boilers for applying heat; for improvements in the manufacture of iron and salt. The improvements in the manufacture of iron are stated in the specification to consist in putting certain ingredients into fusion with pig and sow iron, viz., the ashes of wood and other vegetables, glass, salt, kelp, and pit-ash cinders from iron furnaces and forges, which ingredients being so put into fusion or melted with pig, sow, or other brittle iron will make the like change as charcoal does in the fire called the finery in common forges, and will render the same into a state of malleability, as to bear the stroke of the hammer, to draw it into bars or other forms at the pleasure of the workman. The specification further states that those or other bars being heated in the said melted ingredients in a long hole, arch, or cavern, are to pass, between two large metal rollers (which have proper notches or furrows upon their surfaces), by the force of the engine thereafter described, or other powers, into such shapes or forms as shall be required. The engine force which was to cause the iron to pass through the rollers, consisted of a large vane wheel hung in a frame in the side of a building, the pressure of the in-current of air being directed upon the extremities of the vanes. It may be presumed to have been a sort of windmill, from which no beneficial result for the purpose proposed could be anticipated. This specification is deserving of notice, as suggesting the use of large metal rollers with notches or furrows on their surfaces

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for bringing the iron, drawn by the force of the hammer into bars, into the received shapes and forms; their use would be more analogous to the use of the old slitting rollers, than to the use according to the invention of Cort after the lapse of more than half-a-century.

The furnaces to be employed, as described in Payne's specification, consisted of a series of "arched caverns," from and through which the fiery particles were to be conducted in succession by "flews" to heat the materials placed therein. From about this time attention would appear to have been directed to caverns as a substitute for the hollow fire and blast in the reduction of the pig or cast into malleable iron, and to the adoption of furnaces closely resembling the reverbatory furnace.

In 1761 a patent was granted to John Wood for a "new way of making malleable iron from pig or sow metal, commonly called cast iron." The conversion, after certain preparatory operations, was to be performed in close vessels in an air furnace, by the aid of certain fluxes which, with the impurities from slag and the iron being brought into a tough and malleable state is wrought into bars under the forge hammer.

In the next year (A.D. 1762) a patent was granted to John Roebuck for "a way of making malleable iron from cast iron." The cast iron was to be melted in a hearth with a blast, and the metal worked until reduced to nature, that is, freed from substances interfering with malleability, then taken out of the fire, separated into pieces, and exposed to the action of a hollow pit-coal fire, heated by the blast of the bellows until reduced to a loop or ball of hot iron, which was to be drawn out under a forge hammer into bar iron. The specification of Roebuck proposes a combination of the hearth with a blast for the melting of the cast iron, and of the hollow pit-coal fire with the blast for the subsequent process of bringing the iron into a mass and state suitable for reduction into bar iron by the action of the forge hammer. The invention of Roebuck has recently been strangely confounded with the puddling process, the invention of Cort more than twenty years afterwards; the former invention was probably intended and may be regarded as an improvement on the well-known blooming process, which was performed by a blast in a hollow fire, whereas Cort's process, known as puddling, is performed without any blast in a reverberatory or air furnace.

This was followed by a patent to John and Charles Wood in the following year (A.D. 1763) for an invention, described in the specification as an improvement on the former patent of John Wood, two years before (A.D. 1761), for "making cast iron malleable without charcoal or blast in an air furnace." The process described is granulation and melting in close pots with a covering of clay, by which the iron becomes perfectly tough and malleable, and is to be wrought under the hammer into half blooms. This was followed by a patent to Thomas and George Cranage (A.D. 1766), for "making pig iron malleable in a reverberatory or air furnace with raw pit-coal only." The pig iron is to be put into a reverberatory or air furnace, built of proper construction, and without the addition of anything more than common raw pit-coal, and thereby converted into good malleable iron, and being taken red-hot from the reverberatory furnace to the forge hammer, is to be drawn into bars of various shapes and sizes, according to the will of the workman. The Cranages were in the employ of the Coalbrook Dale Company, then under the management of that eminent man Richard Reynolds, to whom, amongst other things, is due the credit of first employing iron instead of wood in the construction of rail or tramways between the Severn and different parts of the works. The manufacture of malleable from cast iron with pit-coal had been carried on for upwards of half-a-century* since its introduction in 1713, under the superintendence of Abraham Darby at Coalbrook Dale, and technically termed the "buzzing process," was the last of the series of inventions the subject of letters patent for the conversion of cast into malleable iron by pit-coal, prior to the puddling process of Cort, eighteen years afterwards, towards which, the use of the reverberatory furnace was a step in the right direction.

Patents were granted in 1771 to John Cockshutt, for "making malleable iron directly from the ore in a finery or bloomery," for "refining pig iron with charcoal into wrought iron," and for "a new finery or bloomery," the invention consisting mainly in charging and heating of the finery, and in the greater supply of air to the metal than in the common way. In 1783 (three months after the first of Cort's patents), a patent was granted to Peter Onions, for "working and refining cast iron, and converting the same from a fluid state into wrought or bar iron," by running the cast iron direct from the smelting into another furnace, in which it was subjected to a blast and fire until the metal became less fluid, and thickened into a kind of paste, when it was stirred and again subjected to the blast, the operation of stirring being continued until the scoria separate and the particles of iron cohere, when the workman collects and gathers them into a lump, and after being re-heated to a white heat is taken to the hammer, and forged into malleable iron. The treatment of the iron in this second furnace has been supposed to be a near approach to the puddling of Cort, but they differ in the material particular of the use of a powerful blast as in the ordinary finery, which was a wasteful and extravagant system, whereas in Cort's system no blast whatever was used, but the process was to be completed, as will hereafter appear, without requiring any blast by bellows, or cylinder, or otherwise.

Such appears to be the state of invention and of speculation in this important branch of manufacture prior to and about the time of Cort's inventions; the labours of so many ingenious men, some of whom had opportunities of practising the different processes described in their specifications, must have materially advanced the state of practical knowledge in the manufacture of iron, particularly in the direction to which their labours were mainly directed, namely, the manufacture of bar-iron from pit-coal. The successful employment of pit-coal in the smelting furnace for the manufacture of cast-iron in the preceding century naturally led to its use and substitution for charcoal in the subsequent process of the conversion of cast into bar-iron; this may have been one cause of the reduction in 1740 of the number of furnaces using charcoal or wood fuel, inasmuch as those having only a casual supply would probably be abandoned by reason of the increased use of the pit-coal or mineral fuel, of which the supply was so abundant.

It is not improbable that the estimate given of the number of furnaces in the time of Lord Dudley is too high, and in 1740 is too low, and that allowing for the increased yield of furnaces working continuously with a constant supply of coal over those working intermittently with an uncertain supply, estimated at from 400 or 420 tons as compared with 60 or 70 tons per annum, the suggested decrease in the quantity of iron made in the country in 1740 as compared with the quantity made in the time of Lord Dudley may not be accurate; calculations made by competent persons on this basis would lead to the conclusion that the quantity must have increased.

However this may be, the quality of the iron was not good; the iron of British manufacture was used only for common purposes, and was not employed in the navy for purposes for which the quality was a material consideration; and in 1784 upwards of 75,000 tons of charcoal bar-iron was supplied from Sweden and Russia for consumption in the naval arsenals and other important works. It is highly probable that specimens of iron of a quality not greatly inferior if not equal to foreign marts were occasionally produced by the skill of British manufacturers working upon some of the suggestions of the many ingenious men who during the preceding century and a half had devoted themselves to a subject of such increasing national importance; the materials, the furnace, the hammers, the rollers, the blowing apparatus were in daily use, but the art whereby iron of a quality suitable for any purpose could be produced with certainty by the manipulation of the unskilled artizan was strictly a mystery; the process whereby such a result was to succeed was not disclosed in any of the specifications referred to, however near previous suggestions and speculations interpreted by the light of successful practice may now appear to have approached thereto. Such have been the characteristics of all progress in every department of knowledge; the fragments, so to speak, of many predecessors are, as it were, gathered up by some fortunate successor and combined into a system which as a whole constitutes, by the common consent of posterity, a landmark in the ocean of speculation, and an epoch in the history of the progress of each particular science. The labours of Henry Cort present such a landmark, and constitute such an epoch in the manufacture of British iron; the practice which he introduced, like the substitution of pit-coal, and the application of the more powerful blast, continues to the present day substantially the same as adopted at the foundry at Fontley, and published to the world in 1783 and 1784 by the specifications of the patents then obtained; the puddling, piling, faggotting, and heating, without the use of the blast and reduction of the iron by rollers, as practiced at Fontley, still survive and form part of the manufacture, whatever additions or alterations may have from time to time been introduced.

* I am obliged to Mr. Norris for calling attention to an inaccurate statement in the preceding article, to the effect that the manufacture of iron with pit-coal at Coalbrook Dale had been attended with no great commercial success; that process appears to have been carried on continuously from its adoption in 1713.

MONEY-MAKING AT THE ROYAL MINT.

No. IV.

THE marking-room by its name conveys no sort of explanation of the operations conducted within it. These operations are, nevertheless, of much importance to the artistic finish of the coins to be produced. It contains eight marking machines mounted on strong mahogany frames, and set in motion by straps running over pulleys, and which are in communication with another line of small subterranean shafting, driven by a 20-horse power engine. Shopkeepers and others, for the detection of guilty servants, have, ere now, *marked* pieces of gold and silver, but the marking pursued at the Mint is, we need not say, for a very different purpose. The "sized,"—or as they might well be named after the judicial ordeal through which they have recently gone, *assized* blanks, are carefully weighed into this room, and then supplied to the attendant markers. A bag containing 720 oz., or 60 lb. troy of the golden pieces is next emptied into a copper pan placed above one of the machines, and a portion of them

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are made to fall into, and fill horizontally, or surface upon surface, a couple of feeding tubes. The machine is then started, and straightway the two pieces at the bottom of the tubes are made, by means of a couple of thin sliders, or miniature "shovels," as they are we believe technically called, to advance from beneath the tubes. The pieces are at the same time made to revolve—still in a horizontal position—between two grooved steel cheeks at a requisite distance from each other to administer a considerable amount of pressure to the circumference of the pieces, and, in fact, to raise a rim or protecting edge upon them at the expense of their diameters, which are thus lessened. The marked blanks, after this squeezing, are ejected by the action of the machine itself, and fall forward into a basket lined with pig-skin, and placed to catch them. In the return stroke of the sliders they carry two other pieces from beneath the tubes to the other end of the machine, where a similar amount of pressure is administered to them, and they are deposited in the basket below; this alternate motion is quickly repeated. The attendant has to take especial care that the pieces fall flatly into the tubes, and to keep up a constant supply, whilst a frequent testing of the work, produced by the aid of a steel gauge collar, is necessary also. The pieces must be made of uniform diameter, or as coin presently they would exhibit palpably the irregularity, and then be consigned to the melter, a "consummation" not to be wished at all, much less "devoutly." These machines are rapid in their movements, and 240 blanks per minute are consequently thrown into the basket from each. It must not be supposed that the milling on the edge is given in this way, or at this stage of the process of coining, as many persons imagine. That is, on the contrary, as will be shown, one of the last episodes in the gestative history of the sovereign, and all other milled coins struck at Tower Hill. The marking gives a plain rim only, and the object of this is to render it less necessary to put a very heavy strain on the dies afterwards in the coining press. The protecting edge of the future coin is in fact thus raised, and made ready to receive the *ingrailing* or beading from the obverse and reverse dies. As soon as one bag of the seeming shankless buttons have been properly "marked," they are returned with the ticket — duly numbered — of their weight to their beg, and are ready for the following process. Of course, in describing the progress of one of these quantums, we have described that of the whole batch of gold of which we have been in pursuit, and it may simplify our subsequent revelations if to that one quantum we confine hereafter our attention. Leaving, then, our friend the marker to his monotonous duty, we follow the bag in question. The officer of the marking, annealing, and stamping branch again verifies, by weighing, the quantity received from the machine, and this time virtually counts them. He divides them into four parcels of 180 ozs. = 15 lbs. troy, or 701 pieces. These parcels are henceforth, when placed in smaller bags, denominated *journies*—from, as formerly explained, the French word *journée*, a day's work—and there is no doubt that in the days of the Norman rule in this kingdom, 701 coins were considered a very good day's work on the part of King William's minters.

The four journies of gold are now carefully folded and placed in a butcher's tray, or a vehicle much resembling that dangerous article, and transferred to the annealing-room. Here there are eight ovens, each with an iron door fitted with chains and counterpoise weights; and there are in addition tables plated with iron, small carriages of the latter material, square shallow cast-iron pans with shifting covers, open wrought-iron pans without covers, copper tubes, pot clay, and other paraphernalia for the carrying out of the baking business previously adverted to. The oven then, it may be imagined, is already heated by means of a Jucke's patent furnace, and there is nothing but to supply it with the rich batch to be acted upon. Well, the four journies are now once more mixed, and they are placed this time in a mahogany ranging-tray. This has flutings in it, and when shaken the blanks naturally range themselves on their edges in the flutings, and thus render it easy for the worker to take up *rouleau* after *rouleau* of them for deposition in the annealing-box. This becomes useful next, and it is of just sufficient dimensions to receive on their edges, and comfortably—that is, without pressing them into it—the 2,804 will-be sovereigns. If this rectangular box were too small, the expansion of the gold pieces by heating would inevitably cause it to fly assunder. Therefore it is that room must be given to allow for their increased bulk. The 2,804 hard pieces of gold — become hard by compression in the laminating and drawing operations—safely ensconsed in their box, are covered with thick wrought-iron tops, "to make assurance doubly sure" that no air shall oxidize their surfaces, nor cause volatilization, and with pot clay the joints are plastered over. A carriage mounted on small wheels is in waiting at the oven's mouth to receive the rich freight; it does receive it speedily by use of block and fall, and then the whole is backed into the oven, forming thus a more expensive pie than poor Soyer or Mrs. Smith ever dreamt of. One hour suffices for the cooking; the box and its contents are brought to a cherry-red heat, allowed for a short time—a few minutes—to remain so, and then withdrawn. The box, removed from its carriage (which awaits, and speedily receives another pie) is placed upon the stone floor to cool. While waiting for its cooling, our readers may be told that in the case of silver being operated upon in this department, the open pans or boxes are used, that metal requiring a different mode of treatment, and the time for annealing it being much shorter than that for gold. As regards copper, *that* is baked in copper cylindrical boxes, made air-tight, brought to a red heat, and plunged immediately into cold water. In each case the metal is softened sufficiently for coining. It is now time, however, to remove the crust of our pie. The lids of the box are accordingly taken off, and it is inverted over a copper dish or tray, which receives the contents. A workman catches this up, carries it to a cistern, and transfers the golden discs to a cullender resting beneath a water-tap. A forcible douché bath is now administered to them, and they are thus freed from all foreign matter. But another process awaits them—they must be also *pickled*; for although fire and water have done much to purify them externally, they are not yet sufficiently bright to become honoured with the impress of majesty. A cast-iron copper—if we may be permitted to use an Irishism—lined with lead, and containing a boiling but weak solution of sulphuric acid, awaits in the blanching-room the coming of the candidates for sovereignty. They are speedily deposited therein, and a workman by aid of an ashen pole stirs them so that each individual blank is brought to face the acid. This pickling affair is the work of a few minutes only in the case of gold and silver, which latter requires a stronger solution of sulphuric acid than its richer neighbour; whilst plebian copper blanks demand some hours of rest in a cold mixture of acid and water. A number of pickling troughs are therefore provided for the indulgence of the last-named.

The pickled blanks of gold are now removed in the cullender, and again a douché bath of water is given them. By this time a change has come over the spirit of their dream. No longer dull and spiritless pieces of very suspicious-looking metal, they appear in their true colours—bright and beautiful. The most sceptical would not now doubt their being gold—the brass buttons have apparently been doubly gilt while in the copper. They are, however, very wet after their repeated baths, whilst it is necessary that, for stamping, they should be perfectly dry. Provision has been made for this difficulty. In the next apartment, the drying-room, is a drying stove, a cast-iron open bed, about seven feet in length and four in width—at a guess—resting upon brickwork, and having a fire and flue beneath it. This is covered with beech-wood sawdust—found to answer the purpose best—and has upon it sieves and other such like appliances. Into one of these sieves our friends are placed when removed from the bath, and by friction with the heated sawdust, the workman in charge of the stove soon gets rid of the moisture upon their faces. He is not, however, satisfied with this. There may be particles of dust adhering to them, and these must be got rid of. He has at hand a muffle—a kind of coffee roasting apparatus made of copper, perforated with small holes, and which can be made to revolve within a hollow heated cylinder of iron. Into this "muffle" he next places the smooth and healthy-looking pieces, and here their "drying-out" is soon made complete. Again the officer receives them at the scales, divides the 2804 into the four packets of 701—the journey weight notes on the ticket the working loss in the various operations, if any there haply be—has them replaced in the butcher's tray, and despatches them to the room in which they are to receive finally the stamp of approbation—the portrait and the superscription of our gracious Queen—and to become sovereigns themselves. Silver and copper blanks undergo processes after pickling analogous to those described, the silver becoming in appearance "frosted," and the copper of a bright salmon colour. Six workmen perform the whole of the duties of the marking, annealing, blanching, and drying-rooms.

We have thus seen that as there is a difficulty in making money outside the Mint, so is there some trouble in money-making within that well-guarded establishment. As a lady is said once to have remarked to an officer who had conducted her through its various departments, "Well! if it gives so much trouble to *make* a sovereign, I'm sure we ought not carelessly to spend it." The gold with which we set out from the refinery of Messrs. Brown and Wingrove has now been cast into bars, laminated, drawn, cut, weighed or *assized*—to coin a new word—marked, annealed or baked, pickled, bathed, and dried out for stamping, and in this stage of progress space warns us that till next week we must leave it. It is hoped, moreover, that thus far, at least, our readers have tracked us in our march through the Mint, and gathered much novel information from our teachings.

THEORY OF NAVAL ARCHITECTURE.

No. VIII.

CONTINUING our explanation of the table given in our last article, page 299, last vol., we observe that after the ordinates have been inserted in their respective compartments, the table may be looked upon as a map on which the elevation of the surface is registered from a fixed level.* We now come to the calculations, and in the first place we will obtain the displacement by "vertical sections." Every ordinate is first multiplied by the number standing at the head of its respective vertical column, thus: all ordinates in the first column, headed keel or 5 W. L., is multiplied by ½, those in the second column headed 4½ W. L. is multiplied by 2, and so on for the others.

Let these multiplications be performed for all the vertical columns, and the results inserted immediately under the respective ordinates, as shown in the table in large figures; in practice these results are written in red ink, by which means they are very readily distinguished from the ordinates. This being performed throughout the columns, we readily see that if we add together the results in each horizontal column, the sum when multiplied by one-third of the interval between the horizontal sections will give the semi-area of the corresponding transverse section. For example, in transverse section 8 the sum of ·05, 5·8, 5·7, 15·4, 13·5, 39·6, and 10.0, equal to 90 05, multiplied by ⅓ of 1·5, the common interval, or ·5, gives 45·025 for the semi-area of that section.

These sums of the results of the ordinates multiplied by their respective numbers in each

* The figures in the horizontal columns give respectively the ordinates for the transverse sections; and those in the vertical columns the ordinates for the horizontal sections.

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horizontal column are placed to the right in the vertical column headed "areas." We must, however, bear in mind that these quantities are not the semi-areas of the several transverse sections; in the present example they are numerically the same as the complete areas of those sections, in consequence of one-third of the distance between the horizontal sections being ½; for multiplying by this fraction, the result is one-half the area of the section, and then multiplying by 2 for both sides gives the same number as is found in the column.

To obtain the displacement from the column headed "areas," these areas, or areas divided by a constant number, might, as we have before stated, be represented by the ordinates of a curve, the line of abscissæ being the middle line of the half-breadth plan, and the ordinates placed at the respective transverse sections, the areas of which they represent.

The area of the figure thus formed will represent the displacement divided by the constant number, one-third of the distance between the horizontal sections. The quantities in this column must, therefore, be multiplied by the numbers for finding the area by the common rule, standing opposite to them respectively in the second vertical column, and the results placed opposite to them in the adjacent column headed "Multiples of areas." The sum of all these numbers, in the present case, equal to 1832·0, when multiplied by ⅓ of the interval between the horizontal sections, or ·5, and then by 4·2, one-third the interval between their vertical sections, giving for a result 3847·2, will be the semi-displacement of the ship in cubic feet.

This multiplied by 2 for both sides gives 7694·4, the displacement in cubic feet for both sides from the L. W. line to upper part of the keel. Were there any portions of the ship outside the extreme sections, these should be calculated by the ordinary rules of mensuration, and added to the above result to give the total displacement. In the present example the only portions situated outside of the extreme sections, are the thin iron keel and the rudder and post, all of which may be safely neglected as inappreciable. The cubic feet divided by 35—the number of cubic feet of sea water in one ton—gives 219·84 as the total displacement in tons to the load water-line.

To obtain the displacement by "horizontal sections," the ordinates in each horizontal column are multiplied by the number opposite to it in the second vertical column from the left; and the results placed immediately to the right of the ordinates, written in red ink, and as is shown in the table in large figures.

Thus:—The ordinates in the horizontal column 1 are multiplied by ½, those in column 1½ by 2; and so forth for all the horizontal columns.

When these are completed, the results will form a series of vertical columns; and it will be seen that the ordinates corresponding to any horizontal section, will have been multiplied respectively by the numbers opposite to them in the second vertical column from the left; the sum, therefore, of the results in the vertical columns, when multiplied by one-third the interval between the vertical sections, give respectively the semi-area of the corresponding horizontal sections. Thus, the sum of these quantities in the vertical column headed L. W. L., or the sum of ·05, 1·8, 1·9, 5·8, 6·0, &c., 3·8, 4·0, and ·05, altogether equal to 236·95, when multiplied by 4·2 will give the semi area of the load water-section.

These sums for the several horizontal sections, inserted at the foot of the respective columns, are 3·6, 55·2, 103·95, 141·5, 171·4, 209·7, and 236·95, and to proceed as before, instead of multiplying each of these quantities by 4·2 to obtain the semi-area of the sections, we shall regard them as the ordinates of a curve, the line of abscissæ of which is the middle line of the body plan, and the positions of these ordinates, the intersections of this line by the horizontal sections.

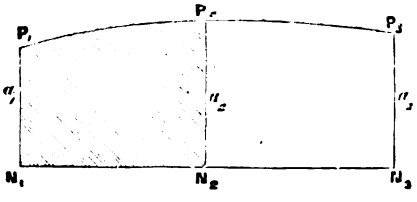
These quantities must, therefore, be multiplied by the numbers standing at the head of the vertical columns, viz., by ½, 2, 1, 2, 1½, 4, and 1 respectively. and the sum of the results, 1832·0, carried to the left side of the table, will, when multiplied by 4·2 and ·5, give the displacement in cubic feet for one side of the ship.

The quantity 1832·0 is the same as that obtained for the sum of the quantities in the vertical column headed "Multiples of Areas." This shows that the *displacement* found by obtaining the areas of the *horizontal sections*, regarding them as ordinates to a curve which forms the boundary of an area representing the displacement, is the same as that found by obtaining the areas of *the vertical sections*, regarding these as ordinates to a curve which forms the boundary of an area also representing the displacement.

The two results should therefore in all cases be identical, or the calculations are incorrect.

We have now explained all that is necessary to obtain the displacement of a ship to the load water-line. Ships, however, very rarely swim at the constructed load water-line, and their draught of water is constantly altering by the consumption and replenishing of stores, in addition to that variation which arises from alterations, such as in the equipment for a man-of-war, and in cargo for a merchant ship; it is, therefore, necessary to find the approximate displacement for all draughts of water. This is done by means of a scale of displacement formed in the following manner:—The displacements to the several horizontal sections are found by methods already given, and which will be described; a line is then drawn, and a point in it taken to represent the under side of the keel of the ship; from this point are set off according to scale the heights of the several horizontal sections above the under side of the keel; at these heights lines are drawn perpendicular to that line; these lines are then taken to represent tons, and their lengths are proportionate to the number of tons displacement to the respective horizontal sections; a fair curve is then drawn through their extremities, from which the displacement may be very accurately found for any draught of water when the plane of flotation is parallel to the constructed load water-line. In order, however, to find the displacement to the 4½ W.L. it will be necessary to deduce a rule for finding a portion only of the curvilinear area $P_1 P_3 N_3 N_1$ when there are three equidistant ordinates (Fig. 15).

FIG. 15.



In our investigations on page 104 we obtained by the summation of a large number ($2n$) of very small trapeziums, the area of the entire figure between $P_1 N_1$ and $P_3 N_3$; but it is clear that we could have obtained any portion of it, such as that between the ordinates $P_1 N_1$ and $P_2 N_2$.

In this case we should have n trapeziums to sum, instead of $2n$ as before taken.

Referring to page 104 we find that the sum of the n trapeziums will be equal to

$$A\left\{\frac{m}{n}+\frac{m}{n}+\frac{m}{n}+\text{\&c. to } n \text{ terms}\right\}$$
$$+\frac{Bm^2}{2n^2}\left\{1+3+5+7+\text{\&c. to } n \text{ terms}\right\}$$
$$+\frac{Cm^3}{n^3}\left\{1^2+2^2+3^2+\text{\&c.}\ldots+n^2\right\}-\frac{n^2}{2}$$
$$=A\times m+\frac{Bm^2}{2}+\frac{Cm^3}{3}\left\{1+\frac{1}{2n^2}\right\};$$

for all values of n, and when n is infinitely large, it is equal to

$$Am+\frac{Bm^2}{2}+\frac{Cm^3}{3}, \text{ since } \frac{1}{2n^2}=\text{Zero.}$$

Putting for A, B, and C their values, as given by the equations on page 104, the sum becomes

$$ma_1+\frac{m}{4}\left(4a_2-a_3-3a_1\right)+\frac{m}{6}\left(a_3-2a_2+a_1\right)$$
$$=\frac{m}{12}\left\{12a_1+12a_2-3a_3-9a_1+2a_3-4a_2+2a_1\right\}$$
$$=\frac{m}{12}\left\{5a_1+8a_2-a_3\right\};$$

which is the area of the part between $P_1 N_1$ and $P_2 N_2$, (shaded in the figure).

To find the area of the portion contained between the ordinates $P_2 N_2$ and $P_3 N_3$; we have only to write a_2 for a_1 in the above equation and it becomes

$$\frac{m}{12}\left\{5a_2+8a_2-a_1\right\}.$$

The sum of these two portions, that is, the entire curvilinear area is equal to

$$\frac{m}{12}\left\{4a_1+16a_2+4a_3\right\}$$
$$=\frac{m}{3}\left\{a_1+4a_2+a_3\right\};$$

which is the second rule.

Rule.—To find the curvilinear area between two equidistant ordinates, such as of the shaded portion of Fig. 15, in terms of three consecutive equi distant ordinates. Multiply the outside ordinate adjacent to the shaded portion of the figure by 5, and the middle ordinate by 8, add the results together, and subtract the other extreme ordinate from the sum; the remainder multiplied by one-twelfth of the distance between the ordinates, will give the area required.

We have already shown that the quantities 3·6, 55·2, 103·95, 141·5, 171·4, 209·7,and 236·95, or the sums of the vertical columns of large figures in the table page 299, are the areas of the several horizontal sections divided by acertain number; in order, therefore, to find the displacement to the 4½ W.L. we have only to multiply 3·6 by 5, 55·2 by 8, the sum of which is 459 6, and subtract 103·95 from it, leaving 355·65 as a remainder; this quantity multiplied by one-twelfth of the distance (1·5 ft.) between the horizontal sections, and one-third the distance between the vertical sections, gives 186·7162 for the displacement in cubic feet to the 4½ W.L., and the corresponding number of tons is 5·3347. To obtain the displacement to the 4 W.L., 3·6, 55·2, and 103·95 are regarded as the ordinates to a curve, and multiplied by ½, 2, and ½ respectively, and then multiplying by the proper proportion of the distances between the horizontal and vertical sections, the displacement in cubic feet is found to be 689·535, and in tons 19·701. The whole of which calculations will be readily made out from the table. In obtaining the displacement to the 3½ W.L. the ordinates 3·6, 55·2, 103·95, and 141·5, are multiplied by 1, 3, 3, and 1 respectively, in accordance with the third rule for finding a curvilinear area; the sum of which results or 622·55 when multiplied by the proper proportions of the distance between the horizontal and vertical sections, will give 1470·7743 for the number of cubic feet displacement to that Line equal to 42·0221 tons.

To find the displacement to the 3rd W.L. The displacement between the L.W.L. and 3 W.L. is found by multiplying 236·95 by 1, 209·7 by 4, and 171·4 by 1, and adding the results together, giving 1247·15; then multiplying in the usual manner, there results 5238·03, which is the number of cubic feet displacement between the L.W.L. and the 3 W.L., and the number of tons in the same is 149·658; this number subtracted from the total displacement, 219·84, leaves 70·182 for the displacement to the 3 W.L.

The same result would be obtained by making the quantities 3·6, 55·2, 103·95, 141·5, and 171·4, the five equidistant ordinates of a curve, and finding the curvilinear area in the usual way.

The displacement between the L.W.L. and the 2 W.L. is obtained in the same way as that between the upper part of keel and the 4½ W.L.—viz., by multiplying 236·95 by 5, 209·7 by 8, add-

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ing the results together giving 2862·35, and subtracting therefrom 171·4, thence leaving 2690·95 for a remainder. This quantity, multiplied by one-twelfth of the distance between the horizontal sections, and then by the constant number 2 × 4·2 before mentioned, will give 2825·4975 cubic feet, or 80·7285 tons for the displacement between these lines; and, therefore, the displacement to the 2 W.L. is equal to 219·84 — 80·7285 or 139·1115 tons.

To form the scale of displacement, a vertical line, as L.W.L., 5 W.L., drawn on page 298, is taken as the axis of abscissæ, and the dotted line perpendicular to it, marked "lower part of keel," as the other axis of co-ordinates. From the point where these axes intersect the heights of the horizontal sections, above the under side of the keel amidships, are set up according to scale; through the points 4½ W.L., 4 W.L., &c., thus obtained, lines are drawn parallel to the dotted line, and from the vertical line distances are set off upon them, proportionate to the displacement in tons to the corresponding [illegible]. The scale in the figure is ¼ of an inch to 10 tons; consequently, the distance from the vertical line to the point in the curve at L.W.L. is 21·984 feet on the "quarter" scale. The distance on the horizontal line at 2 W.L. to the point in the curve is 13·91115 feet; and so on for the others.

The very small displacement below 5 W.L. has been neglected in our calculations; consequently, the curve must meet the vertical line at 5 W.L.

When the curve *(A)* has been drawn through the points thus found, the displacement corresponding to any water-line between 5 W.L. and L.W.L. may be readily found. Thus:—From the dotted line set up a distance equal to the draught of water on the proper scale; and through the point found draw a level line cutting the curve *d*. The distance of their intersection from the vertical line when set off on the scale of tons will give the displacement required.

THE SEWING MACHINE.

A SKETCH OF THE HISTORY OF ITS INVENTION.

THE essential parts of a sewing machine are but few. Machinery is needed only to pass a thread through the fabric, to retain this thread in the fabric after it has been passed through it, to change the relative position of the fabric and the needle for the formation of the stitches, and to tighten the thread in the fabric so as to form a seam. Every combination of machinery which effects these objects is a sewing machine.

There are five varieties of sewing machines: 1st. Embroidering, tambour, or chain-stitch machines. 2nd. Running-stitch machines. 3rd. Compound chain-stitch machines. 4th. Lock-stitch machines. 5th. Back-stitch machines.

In England, the first inventors of these varieties of the sewing machines, and the dates of their inventions, are as follows:—A tambouring, or chain-stitching machine, was first patented by John Duncan, May 30, 1804. A running-stitch machine was first patented by Leonard Bostwick, April 2, 1844. A machine for making a compound chain-stitch, and also a lock-stitch machine, were first patented by John Fisher and James Gibbons, December 7, 1844. The first patent for a back-stitch machine was granted to Frederick F. Robinson, February 7, 1851. Bostwick's machine is extremely simple, and Robinson's is extremely complicated; but as neither has been used to any considerable extent in this country, they deserve to be named only to make the list of varieties complete. John Duncan and John Fisher are the original inventors of the sewing machines used at present in Great Britain. All other patentees have merely improved upon their inventions.

On the Continent several of these varieties were used before they were patented in England. In France tambouring machines were used about the beginning of the present century. A number of the *London Monthly Magazine*, published in 1817, contains an allusion to an Austrian sewing machine, which may be quoted as a literary curiosity:—"A Tyrolian has lately invented, at Vienna, a machine for needlework, by which, it is said, every kind of sewing may be executed with the utmost precision. The Emperor of Austria has granted a patent to the inventor. Should these mechanical perfections make much farther advancement, every thing in the world will shortly be executed by machine."

To Americans, however, the world is indebted for the invention of sewing machines adapted to common use in tailoring, shirt-making, dress-making, boot-making, and similar trades. The high prices paid for common hand-sewing in the United States naturally led to the invention and use of labour-saving machines adapted to plain sewing, just as the high prices of fancy articles for clothing had previously led to the introduction of similar machines among the lace-makers and embroiderers of England. The American inventors who are best known in the United States and in Europe, are Elias Howe, jun., and Sherburne C. Blodgett. The only American manufacturer who is known also as an inventor is J. M. Singer. Elias Howe, jun., has for the past ten or twelve years occupied the first place among the inventors of sewing machines. His patent of September 10, 1846, for the combination of the needle and the shuttle has been generally acknowledged to be at the foundation of the sewing machine trade in the United States. All the leading manufacturers have accepted licences from him, and his income from the royalties thus received is said to amount to not less £20,000 annually. Sherburne C. Blodgett is best known in Great Britain from the fact of his machine being the only one to which a prize was awarded at the Exhibition of 1851. In consequence of this exhibition of sewing machines in London in 1851, and of their exhibition subsequently in Dublin in the following year, the American idea of sewing by machinery became current and popular in this country. Very soon a demand was created for machines superior to those which had previously been used in embroidering and stay-making, and improved machines were rapidly introduced, most of them, however, being of American invention and manufacture. The demand for army clothing during the Crimean war stimulated manufacturers and importers, and the improvements which were being constantly made upon them has tended to increase their usefulness and their sale. In mechanical construction they are rapidly approaching perfection; but it is much to be regretted that the machines sold in England had not been so far reduced in price as to bring them within the reach of the middling classes, and especially of families in moderate circumstances.

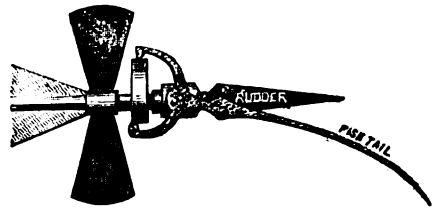
FISH-TAIL PROPELLERS.

THE following interesting letter is from the pen of Captain Selwyn, R.N.:—

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I have read with much interest your account of Mr. Reddie's paper read at the U. S. Inst., May 30, and you will perhaps allow me a few remarks on the subject.

Mr. Reddie is scarcely correct in assuming that the "fish-tail" form of propeller has been so much overlooked. It is mentioned in Appendix D, of the new edition of Tredgold's work, and indeed few seamen who give their attention to such subjects have failed to observe and appreciate the admirable ease with which the ocean fishes, propelled only by this means, are able to pass the most rapid steamer when urged to her highest speed. My own thoughts have often been given to the subject; but the difficulty to be met *is*, or I may say, I think, *was this*, that no backward motion, no "going astern," so essential to steamers, could be obtained from such a form of propeller. I now see reason to believe, however, that this apparently insuperable difficulty only arose from our not having studied nature quite closely enough. In all those fishes (and there are many) which are capable of rapid backing or stern motion, the breast fins or paddles are used for this purpose, and there seems no reason why we should not avail ourselves of the backing powers of the screw, *combining with it* the high velocity of forward motion to be obtained from the use of the fish-tail at the same time astern of the rudder. It is well known that one defect of the screw is, that it does not, under all circumstances, *e. g.*, head to wind, utilize sufficiently the steam power which might be applied to it if there were more perfect resistance. This, any greater area brought to bear on the resisting medium, would effectually absorb; but no advance with the screw alone, in this direction, is possible without at the same time increasing the draught of water. I will give a brief description of the mode of construction and appliance of a "fish-tail" propeller, according to this view. The propeller should first be framed with a central boss, and with hammered brass springs exactly like the bones of a fish's tail projecting from it above and below. Then this framework should be covered with india-rubber, to complete the imitation. The motion might be obtained from the end of the screw shaft by an eccentric, working in a frame which would give



reciprocating horizontal, with... ary vertical motion from the combined circ... motion of the shaft, and this would admit of ... joint which is of course necessary being placed in the false stern post or rudder, as most advisable. The rudder would be cut through and jointed, as in the case of those screws which now work astern of the rudder, and which are not uncommon. To provide for the cessation of motion in the fish-tail when going astern, it would be necessary to give a certain degree of "fore and aft" play to the eccentric on the screw shaft, so that the back pull should disengage the eccentric from its frame.

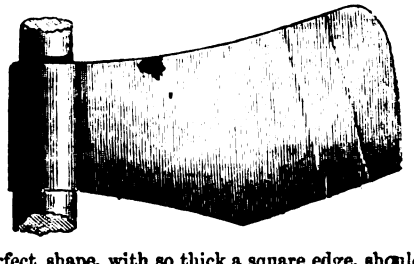
This is, of course, only a rough idea and sketch of what I believe might be done; but it is clear that if practicable, the speed may be greatly increased of all screw vessels, and perhaps also a more efficient power be obtained of steering straight astern.

J. H. SELWYN.

W. Crag, Grasmere, June 15, 1859.

THE EXPERIMENTAL SCREW PROPELLER.

THE annexed figure is an authentic representation of the shape to which the propeller was reduced by cutting off its leading corner in the late experiments made with the Doris. It will be perceived that by thus cutting in a straight line, instead of rounding off the corner, two other corners are formed, and the cut being across the thickness of the metal in the blade, a blunt surface was left, which consequently met with greater resistance from the water than it would if chamfered to an edge. That a blade of this im-



perfect shape, with so thick a square edge, should have proved its merits sufficiently to stand second in the order of merit of the propellers tried on that occasion would seem to amount to a proof that a blade formed, as Sir Howard Douglas proposed, in a fair flowing curve throughout, with the leading edge made fine, would be still more successful.

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BUNNETT'S PATENT SELF-SUPPORTING FIRE-PROOF FLOORS, ROOFS, AND ARCHES.

FIG. 1.

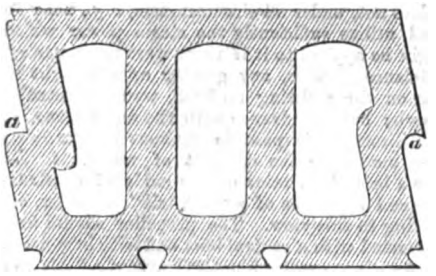


FIG. 2.

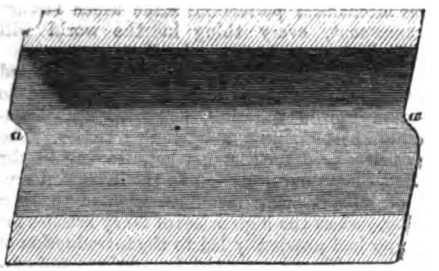


FIG. 6.

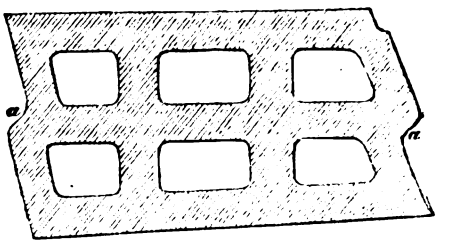


FIG. 3.

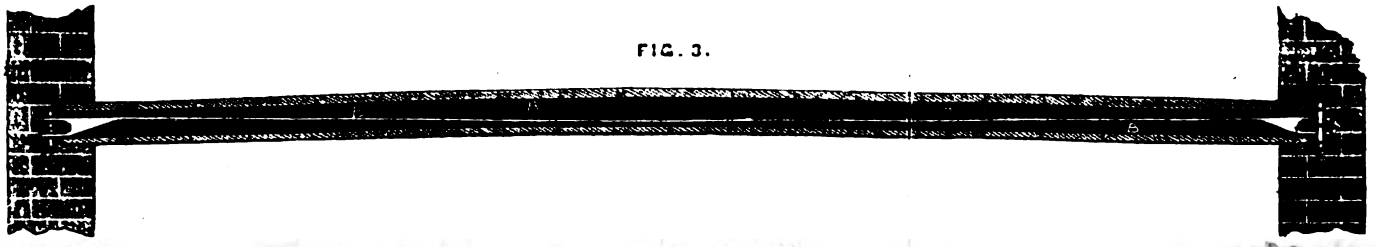


FIG. 4.

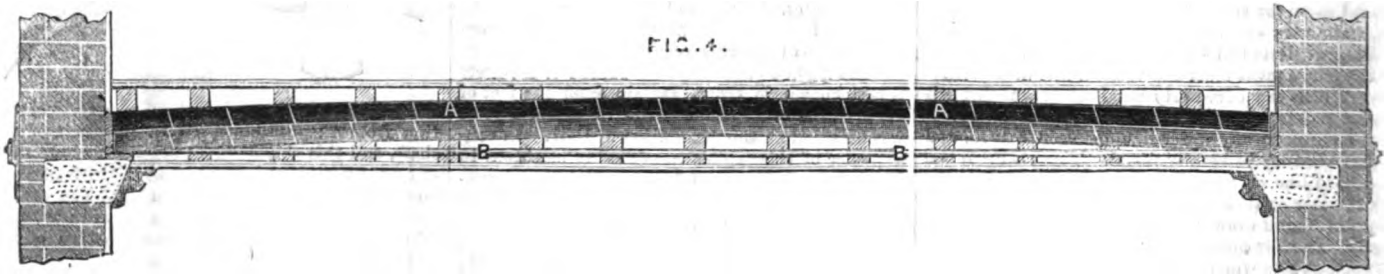
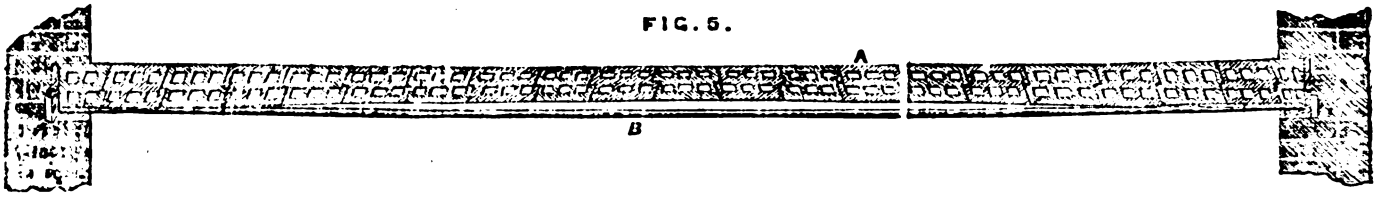


FIG. 5.



BUNNETT'S PATENT SELF-SUPPORTING FIRE-PROOF FLOORS, ROOFS, & ARCHES.

By W. BADDELEY, C.E.

THE recent disastrous conflagration of an oil and turpentine warehouse in Line-street has caused considerable excitement among the citizens, and led to an inquiry as to the best method of preventing a recurrence of such a disaster. Two things appear to be plainly demonstrated by this fatal occurrence, viz., that large depositories of such highly-inflammable materials ought not to be tolerated in such densely-crowded localities; and that all warehouses for containing such stores, wherever located, should be of fire-proof construction.

Had the building where this unfortunate but purely accidental calamity took place been composed of incombustible materials, with such well-known adjuncts as science furnishes for the purpose, it is almost certain that the contents of one floor only would have been consumed, without any damage to the surrounding properties. As it was, the vast amount of combustible matter employed in the construction of the building literally added "fuel to the fire," increasing the fury of the flames and extending their ravages in all directions around.

Although it is admitted that it is almost practically impossible* to construct an absolutely fire-proof building, still much may be done by a judicious disposition of even combustible materials,* to retard the progress of fire and give time for the application of remedial measures. Many plans have been devised for the construction of fire-proof houses within the last half century, and of these, the last appears to be the most practical. I allude to the methods of constructing self-supporting fire-proof floors, roofs, and arches, recently patented by Mr. Bunnett, the well-known builder's engineer, of Deptford. This invention was briefly noticed in the annual report of London fires for 1858 (ante page 206), and as it is now exciting much interest in the building world, the following additional particulars may probably be interesting to your numerous readers.

Bunnett's fire-proof floors are constructed of hollow or cellular bricks, so formed, externally, as to lock into each other on all sides, so that, when laid to break joints, each brick receives the direct support of six adjoining ones, carrying out a principle of mutual support over the whole extent of the floor.

Figures 1 and 2 show a transverse and longitudinal section of one of these cellular bricks made of clay or brick earth; they are produced by forcing the plastic clay through dies or moulding orifices, the dies being so formed as to cause each block to be produced with two of its sides of a suitable shape to overlap and be overlapped by the adjacent bricks. The form of the overlapping parts *a a* may be varied, but it is believed that the form of block shown above is as convenient as any for the construction of floors and roofs of a fire-proof character.

In addition to the two sides of each block being made so as to give support to, and receive support from other blocks, the ends of each block are also so cut as to give and receive a similar support.

Fig. 3 shows a floor composed of these blocks, laid in cement, and farther held in position by tie-rods or bars *B*, at intervals, which pass through the hollow spaces formed within the blocks *A*, to plates of angle iron *C*; so that the entire thrust of the arches is received and sustained by the rods and plates *B*, *C*. The end of the arches thus produced may be built into walls, or carried by piers or other supports, according to the purpose to which it is to be applied, whether for the construction of floors, or roofs of houses, bridges, &c., &c. In Fig. 3 the floor is slightly canted, which would, for many purposes, be thought advantageous; but Fig. 4 shows the method of proceeding when a flat-boarded floor is to be laid upon the arch with a ceiling underneath.

In this case the tie-rods, *B*, are shown as passing below the bricks (instead of through them), and through the walls, forming supports for the ceiling joists.

Fig. 5 shows a fire-proof floor, or roof, constructed of graduated cellular bricks, with a central key-brick, forming a perfectly flat floor on the upper surface, but arched on the underside. *A* are the blocks, *B* the tie-rod, and *C* the angle iron wall plates.

Fig. 6 is a section of one of the graduated cellular blocks employed in the construction of the floor, Fig. 5. The advantages of these fire-proof floors consist in the facility and cheapness with which they can be constructed; their capacity to resist and remain unaltered by heat; their great strength, and fitness for the reception of wood floors, cement, plaster, imitation of marbles, or

* "There is a description of floor, which although not altogether fire-proof, is almost practically so. It is composed simply of plank 2½ or 3 inches thick, so closely joined and so nicely fitted to the walls as to be completely air-tight. Its thickness and its property of being air-tight will be easily observed to be its only causes of safety."—*Braidwood on Fire-engines*.

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encaustic tiles, in which case they will not exceed in thickness an ordinary floor with joists.

Arches upon this principle are well adapted for cheap and durable bridges of a moderate span, as well as for beams, girders, &c.

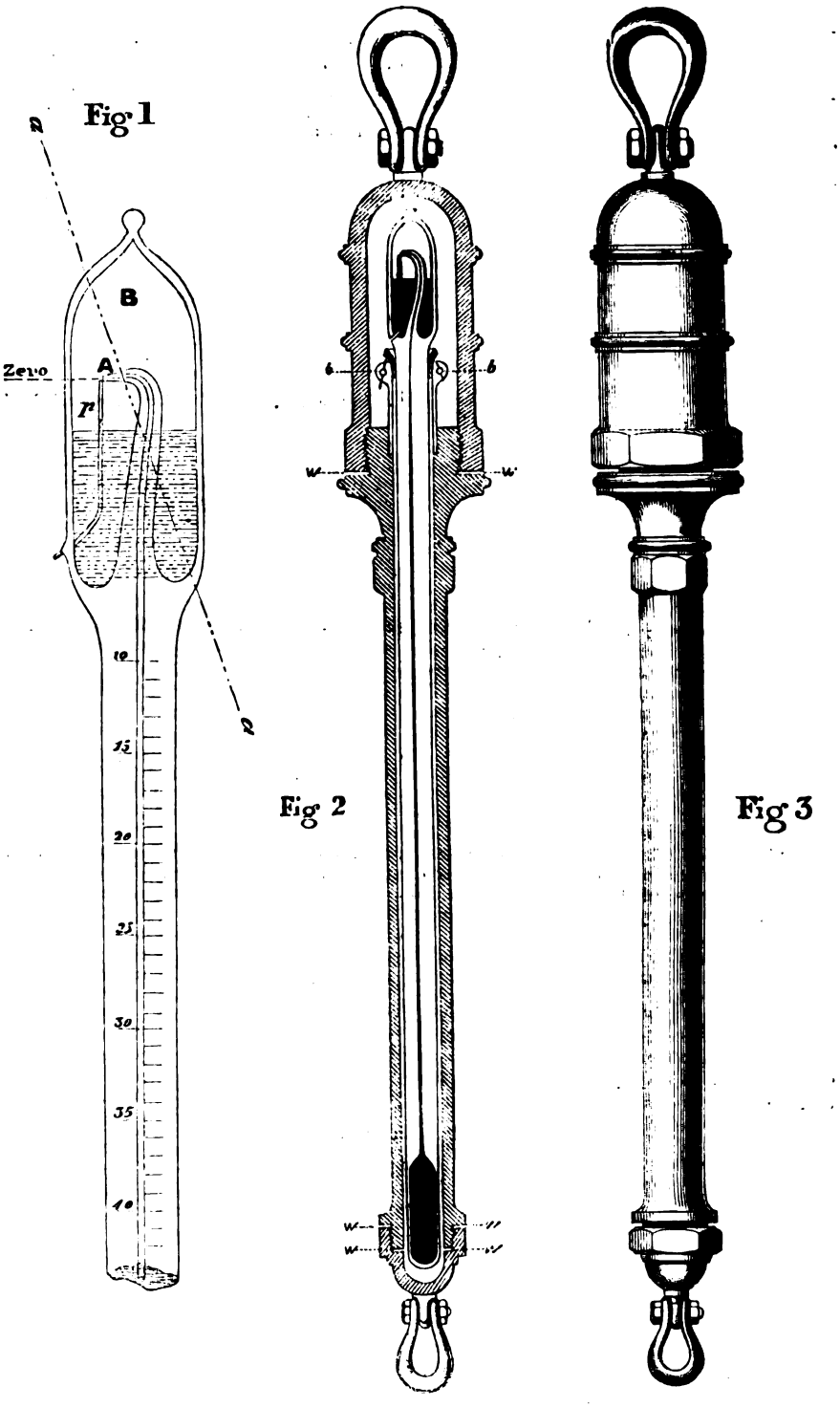
Persons desirous of availing themselves of this admirable invention will do well to visit Mr. Bunnett's works at Deptford, where practical demonstrations of the strength and capabilities of floors of this description may be seen and tested.

SCOTT'S COMPENSATION SELF-REGISTERING MAXIMUM THERMOMETER, FOR DEEP-SEA OBSERVATIONS.

MR. WENTWORTH L. SCOTT, of Brunswick-terrace, Westbourne-grove, has favoured us with the following description of his thermometer for deep-sea observations, which was exhibited at this year's Exhibition of Inventions at the Society of Arts.

This instrument consists of a glass tube with a cylindrical bulb containing mercury (as in the ordinary thermometer) at its lower extremity; but at the top the stem is drawn on into a fine jet, bent at right angles, *A*, Fig. 1; in the interior of the second bulb, *B*, Fig. 1, this upper bulb is about half filled with mercury, the remaining space being a vacuum; near its base a platinum wire, *p*, is welded into the glass and bent upwards so that its point is nearly in contact with that of the jet. It is obvious that when the instrument is "set," *i.e.* the lower bulb and capillary tube to the point of the jet completely filled with mercury—any rise of temperature will expand the mercury and cause it to overflow in minute globules into the reservoir above. The platinum wire is simply for the purpose of preventing the formation of large drops at the point of the jet, by its superior attraction for the fluid metal. Upon cooling, the mercury now remaining will of course sink in the tube. The instrument is so graduated that if it were cooled to 0 deg. Fahr. the level of the mercury would precisely indicate the highest temperature to which it had been previously exposed; but if the observation were made at the atmospheric temperature the mercury would stand exactly as much higher in the tube, *i.e.*, lower in the scale, as the temperature of the air was above 0 deg. Fahr.; therefore to ascertain the maximum temperature it is only necessary to add to the degree at which the mercury stands the temperature at the time the observation is made. Thus, supposing the "compensation" thermometer marks 35 deg., and an ordinary instrument by its side is at 50 deg., 85 deg. will be the highest temperature that has occurred since the last observation. To "set" this thermometer, the lower bulb must be gently raised until the mercury runs down the tube into the reservoir-bulb; when contact has thus been established between the two portions of the metal, the reservoir-bulb is slightly elevated, care being taken to keep the point of the glass jet under the sun-face of the metal (the dotted line *a a* in the diagram represents the level of the mercury during this operation). The mercury will now flow back into the lower bulb and refill the small vacuum produced by the previous decantation, when, upon restoring the instrument to its original vertical position, the tube will be full to the extreme point of the jet. It will be at once seen that vibration or agitation cannot militate in any degree against the accuracy of this instrument, no moveable indices being employed. Fig. 1 gives a view of the upper bulb, and a portion of the scale, of the actual dimensions. Fig. 2, one-third full size, shows a section of the entire instrument in a gun-metal tube for deep-sea experiments. Fig. 3 is an external elevation. The thermometer is "set," and inserted in the tube (into which, after greasing, a little mercury has been poured), oscillation being prevented by rings of vulcanised india-rubber, the upper one clamped by the binding screws *b b*; lastly, the cap is tightly screwed on, the arrangement being then ready for use. Well greased leather washers occupy the spaces at *w w*. The silver medal of the Society of Arts has recently been awarded to the inventor for this instrument. It has also been examined and approved by Rear-Admiral R. Fitzroy.

SCOTT'S MAXIMUM THERMOMETER.



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BUNNETT'S PATENT SELF-SUPPORTING FIRE-PROOF FLOORS, ROOFS, AND ARCHES.

FIG. 1.

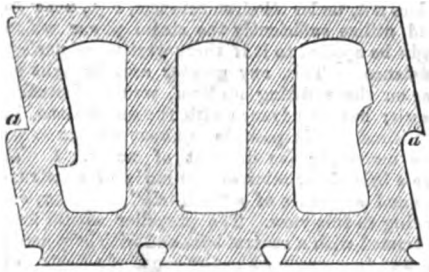


FIG. 2.

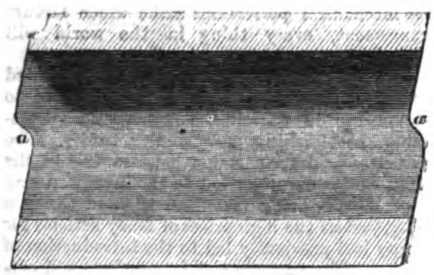


FIG. 6.

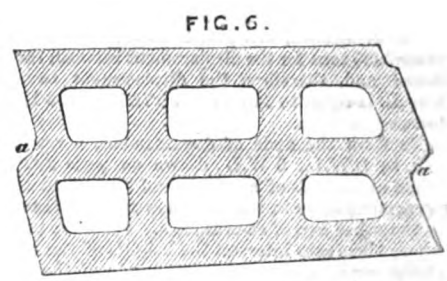


FIG. 3.

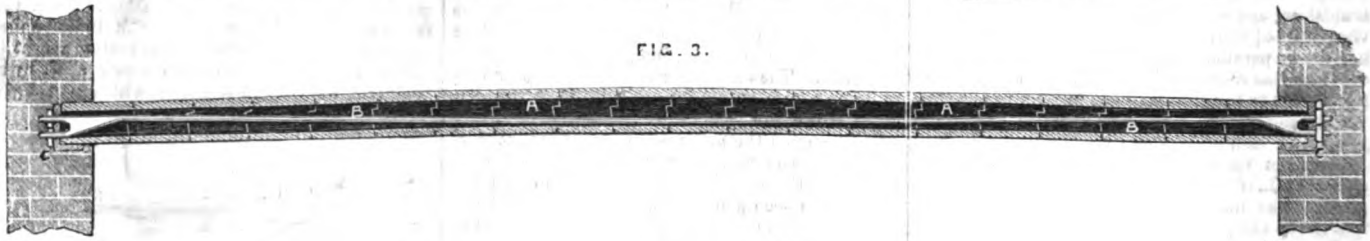


FIG. 4.

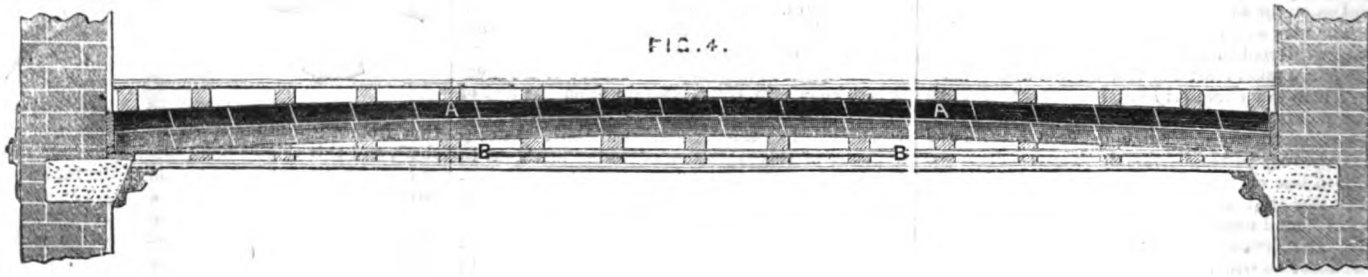
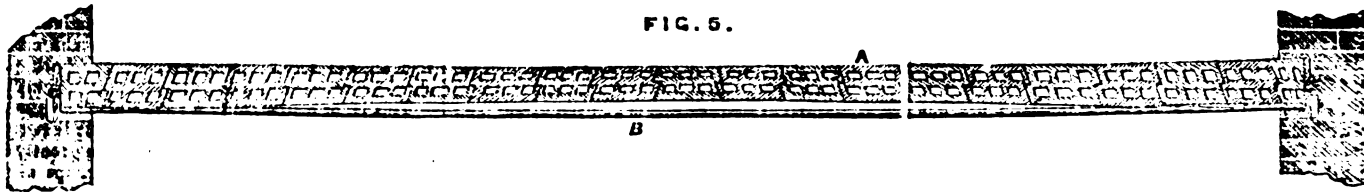


FIG. 5.



BUNNETT'S PATENT SELF-SUPPORTING FIRE-PROOF FLOORS, ROOFS, & ARCHES.

By W. RADDELEY, C.E.

THE recent disastrous conflagration of an oil and turpentine warehouse in Linte-street has caused considerable excitement among the citizens, and led to an inquiry as to the best method of preventing a recurrence of such a disaster. Two things appear to be plainly demonstrated by this fatal occurrence, viz., that large depositories of such highly-inflammable materials ought not to be tolerated in such densely-crowded localities; and that all warehouses for containing such stores, wherever located, should be of fire-proof construction.

Had the building where this unfortunate but purely accidental calamity took place been composed of incombustible materials, with such well-known adjuncts as science furnishes for the purpose, it is almost certain that the contents of one floor only would have been consumed, without any damage to the surrounding properties. As it was, the vast amount of combustible matter employed in the construction of the building literally added "fuel to the fire," increasing the fury of the flames and extending their ravages in all directions around.

Although it is admitted that it is almost practically impossible to construct an absolutely fire-proof building, still much may be done by a judicious disposition of even combustible materials,* to retard the progress of fire and give time for the application of remedial measures. Many plans have been devised for the construction of fire-proof houses within the last half century, and of these, the last appears to be the most practical. I allude to the methods of constructing self-supporting fire-proof floors, roofs, and arches, recently patented by Mr. Bunnett, the well-known builder's engineer, of Deptford. This invention was briefly noticed in the annual report of London fires for 1858 (ante page 206), and as it is now exciting much interest in the building world, the following additional particulars may probably be interesting to your numerous readers.

Bunnett's fire-proof floors are constructed of hollow or cellular bricks, so formed, externally, as to lock into each other on all sides, so that, when laid to break joints, each brick receives the direct support of six adjoining ones, carrying out a principle of mutual support over the whole extent of the floor.

Figures 1 and 2 show a transverse and longitudinal section of one of these cellular bricks made of clay or brick earth; they are produced by forcing the plastic clay through dies or moulding orifices, the dies being so formed as to cause each block to be produced with two of its sides of a suitable shape to overlap and be overlapped by the adjacent bricks. The form of the overlapping parts *a a* may be varied, but it is believed that the form of block shown above is as convenient as any for the construction of floors and roofs of a fire-proof character.

In addition to the two sides of each block being made so as to give support to, and receive support from other blocks, the ends of each block are also so cut as to give and receive a similar support.

Fig. 3 shows a floor composed of these blocks, laid in cement, and farther held in position by tie-rods or bars *B*, at intervals, which pass through the hollow spaces formed within the blocks *A*, to plates of angle iron *C*; so that the entire thrust of the arches is received and sustained by the rods and plates *B*, *C*. The end of the arches thus produced may be built into walls, or carried by piers or other supports, according to the purpose to which it is to be applied, whether for the construction of floors, or roofs of houses, bridges, &c., &c. In Fig. 3 the floor is slightly canted, which would, for many purposes, be thought advantageous; but Fig. 4 shows the method of proceeding when a flat-boarded floor is to be laid upon the arch with a ceiling underneath.

In this case the tie-rods, *B*, are shown as passing below the bricks (instead of through them), and through the walls, forming supports for the ceiling joists.

Fig. 5 shows a fire-proof floor, or roof, constructed of graduated cellular bricks, with a central key-brick, forming a perfectly flat floor on the upper surface, but arched on the underside. *A* are the blocks, *B* the tie-rod, and *C* the angle iron wall plates.

Fig. 6 is a section of one of the graduated cellular blocks employed in the construction of the floor, Fig. 5. The advantages of these fire-proof floors consist in the facility and cheapness with which they can be constructed; their capacity to resist and remain unaltered by heat; their great strength, and fitness for the reception of wood floors, cement, plaster, imitation of marbles, or

* "There is a description of floor, which although not altogether fire-proof, is almost practically so. It is composed simply of plank 2½ or 3 inches thick, so closely joined and so nicely fitted to the walls as to be completely air-tight. Its thickness and its property of being air-tight will be easily observed to be its only causes of safety."—*Braidwood on Fire-engines*.

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encaustic tiles, in which case they will not exceed in thickness an ordinary floor with joists.

Arches upon this principle are well adapted for cheap and durable bridges of a moderate span, as well as for beams, girders, &c.

Persons desirous of availing themselves of this admirable invention will do well to visit Mr. Bunnett's works at Deptford, where practical demonstrations of the strength and capabilities of floors of this description may be seen and tested.

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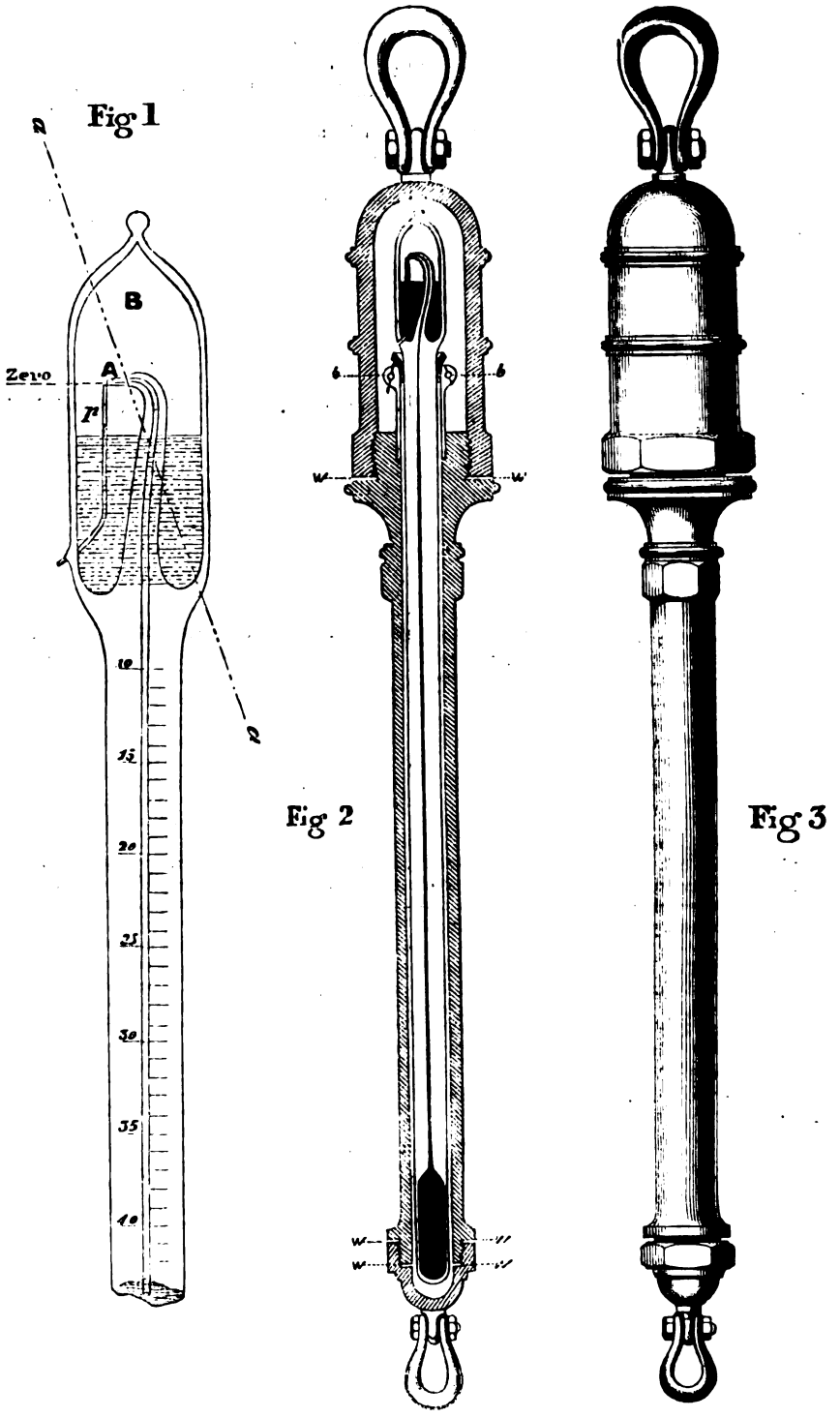

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Literature.

The Globe Telegraph: an Essay on the use of the Earth for the Transmission of Electric Signals. By SEPTIMUS BEARDMORE, C.E., F.R.G.S. London, 1859. Edward Stanford, Charing Cross.

IN July of last year, when telegraphists, perplexed with induced currents and earth currents, losses of insulation, and consequent losses of electricity, were far from sharing in the unmingled exultation with which the public of two great nations received the news of their electric union, an amateur student of electricity applied himself to the consideration of the various difficulties of ocean telegraphing, and arrived at a definite idea of the means whereby they might be overcome. This gentleman, M. Hoga, in conjunction with Mr. Piggott, well-known for his application of electricity as a medical agent, and with the author of the present pamphlet, commenced a series of experiments, which, though begun on mistaken grounds, soon assumed a scientific character. The principle on which these experiments were based, and which they served to confirm, was one which was not new in the science of electric telegraphy; though the experimenters, like many others who have laboriously explored what was already mapped out and described, were perfectly unaware of its having been previously investigated and even made the subject of a patent. Nevertheless, so far back as 1843, Mr. Bain had secured the application of simple, positive, and negative plates for telegraphic purposes; which plan, having been relinquished by the original inventor, was now adopted, and ultimately considerably extended, by the new experimenters, as a means of obtaining an electric current of low "intensity" and considerable quantity, in which the loss from imperfect insulation, and the retardation from an induced charge, should be reduced to their *minimum*. On the 17th November, 1858, Messrs. Hoga, Piggott, and Beardmore took out a joint patent for "Improvements in Electric Telegraphs," in which, acknowledging the prior claims of Mr. Bain, as originator of the groundwork of the system, they secured to themselves the discovery of the means by which it might be brought into practical use.

Although the value of this system is a matter to be determined by extended experiments rather than by theoretical arguments, we will place before our readers a brief *aperçu* of the more manifest advantages to be looked for in its application.

The following diagram, No. 1, represents the existing mode of employing electricity for telegraphs:—

DIAGRAM No. 1.

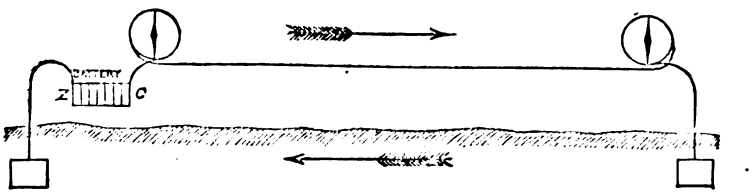
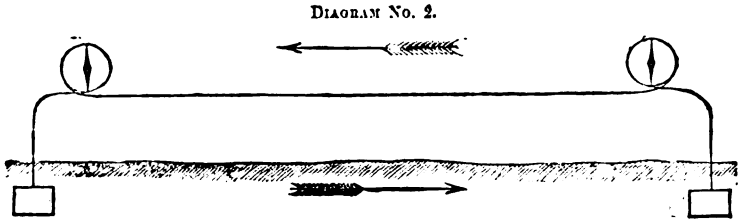


DIAGRAM No. 2.



As in the method presently to be described, one half of the circuit is here completed by the earth in the direction of the lower arrow; the "earth plate" at the zinc end being *negative*, and that terminating the wire *positive*. From the dissimilarity of the electric character of the wire and of the earth-plate at the battery-station, results a constant tendency of the current, transmitted by an imperfectly insulated wire, to escape to this plate by the shortest route, in lieu of completing the circuit through the second instrument and the positive plate; and hence the loss of electricity which invariably occurs in this system according to the "tension" power of the battery. In the method proposed by the inventors of the globe telegraph, these conditions are altered, as will be seen by a glance at the diagram, No.2:—

It is evident that the current can here have no tendency to the plate whence it flows, since it cannot complete the circuit without passing through the second instrument and the opposite plate. Hence it was at first assumed by the inventors of the globe telegraph that insulation of the conducting wire was unnecessary. But, as was soon ascertained by them, the wire, if left uninsulated, would become an element in the voltaic arrangement, replacing the positive element at the station, and rendering the transmission of signals impossible

In the lines established at the period of Mr. Bain's experiments, the loss of electricity in the existing method of working telegraphs was of little moment. In the longest submarine circuit of the present day, however, this loss of power and the induction charge caused by the electric tension, have been fatal to the success of the undertaking. And, though the tension may in this system be reduced to a certain point, yet the conditions which determine the escape of the electric fluid cannot be altered without having recourse to the current produced by the single couple of positive and negative elements.

It has been asserted, but without sufficient proof, that *tension* electricity is necessary to overcome the resistance of a wire to the transmission of the current. An idea was also prevalent, and appears to have been received by Mr. Bain, that the surface of the plates in a simple galvanic arrangement requires to be rapidly augmented in proportion to the distance between them. The ratio in which this increase is necessary has now been ascertained to be in accordance with the square root of the increase of distance. Thus, if one square inch of the metals produce a certain deflection of the galvanometor at a distance of 10 feet, 2 square inches will be sufficient to produce the same deflection at a distance of 40 feet, and 8 square inches will have the same effect when the plates are 640 feet apart. And thus, to work the cable between St. John's and Valentia, a surface would be required of less than 7 square feet of each metal. With regard to the resistance of a wire to the transmission of a current, which bears an inverse proportion to the diameter of the conductor, it is apprehended that there would be little difficulty in increasing the size of the wire, should this be found necessary, to a very considerable extent.

The above diagram, No. 2, represents Mr. Bain's arrangement, which also forms the groundwork of the system now proposed by the patentees of the Globe Telegraph. In this system, however, an important extension of the original plan has been effected with regard to the return current, necessary to deflect a needle in either direction. To obtain this return current it is proposed to employ a metal intermediate in its voltaic character to the copper or platinum on the one hand, and to the zinc on the other. A plate of iron is found to fulfil this condition, transmitting a positive current to the zinc and a negative current to the copper. For a full explanation of the arrangement by which the three metals at either side are employed to produce the reverse signals we refer our readers to the specification of the patent, or to Mr. Beardmore's pamphlet.

The necessity of diminishing the resistance offered to the transmission of the current by the telegraphic wire is beginning to be fully recognised. It is of little avail, however, that the diameter of the main conductor should be increased, if long coils of fine wire are to be employed in the instrument through which the current takes effect. As no wire can be stronger than its weakest part, so must its power of conductibility depend upon its least-conducting portion; for any impediment in one part of an electric circuit must influence the total amount of electricity that can be transmitted. With currents of high static intensity, a long coil of fine wire is requisite; a short coil of thick wire being scarcely influenced by electricity in this condition. On the other hand, with dynamic currents of low intensity, the contrary is the case; a single turn of thick wire being very sensitive, while the ordinary coils are scarcely affected. With the increased necessity, therefore, of diminishing the resistance in the new system, increased facilities for effecting the same are also presented, and will doubtless be profited by. It is to be hoped that no time will be lost before further and more extended experiments are made to determine the practical value of an invention which appears to be called for by the requirements of the times. Its advantage in point of cheapness is but a secondary consideration, if it meets, as the *primâ facie* theoretical evidence tends to prove, the difficulties which have been so fatal to the success of the Atlantic cable.

LIST OF NEW BOOKS.

Beardmore's The Globe Telegraph, 5s. 6d.
Burgoyne's Military Opinions, &c., edit. by Wrottesley, 14s.
Field Exercise and Evolutions of Infantry, 1859, 3s. 6d.
Gwilt's Encyclopædia of Architecture, 42s.
Herbert's The Sanitary Condition of the Army, 1s. 6d.
Herschell's Manual of Enquiry, 3rd edit., by Main, 9s.
Hogg's The Microscope: its History, 6s.
Household Encyclopædia, vol. 2, 15s. 6d.
Hunt's Universal Yacht List, 1859, 4s.
James's Naval History of Great Britain, new ed., vol. 2, 5s.
Kennedy on Defences of Great Britain and Ireland, 1s. 6d.
Manual of Punctuation, by a Practical Printer, 1s.
Maury's Physical Geography of the Sea, new edit., 5s.
National Cyclopædia of Useful Knowledge, 5s.
Our Naval Position and Policy, 12s.
Philp's History of Progress in Great Britain, 7s. 6d.
Reid's Mental Arithmetic, 1s. 3d.
Remarks on Coinage, with Decimal Coinage, 1s.
Tomlinson's Thunder Storm, 3s. 6d.
Volunteer's Handbook, 1s.
Ward's Telescope Teaching 7s. 6d.

THE NEW IRON STEAM RAM.

THE following article, which we take from the *Times*, of yesterday, contains fuller information on some points respecting the Government iron steam frigate than has yet appeared:—

The English Government have very wisely determined to build a wrought-iron vessel of immense size, strength, and steam power, specially adapted as a vessel of war, and for running down ships of the largest kind, not even excepting the Great Eastern itself. The contract for this tremendous engine of modern war has been taken by the Thames Iron Shipbuilding Company, and sufficient progress has been made with the ironwork to be used in her to make it certain that she will be afloat and fitting for sea by June next. Her dimensions will be—extreme length, 380 feet; breadth, 58 feet; depth, 41 feet 6 inches; and her tonnage no less than 6,177 tons. The weight of the empty hull will be 5,700 tons. The engines are to be by Penn and Sons, of 1,250-horse power,

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and of these we shall give a description on another occasion. Their weight with boilers will be 950 tons; she will carry 950 tons of coal, and her armament, masts, stores, &c., will amount to 1,100 tons more. Thus at sea her total weight will be about 9,000 tons, which will be driven, when so wanted, through the water against an enemy's ship at the rate of 16 miles an hour. It is difficult by mere description to give an adequate idea of the tremendous strength with which this vessel is to be built. The keel, or rather the portion to which the ribs are bolted, is made of immense slabs of wrought scrap iron, an inch and a quarter thick, and three feet six inches deep. From this spring the ribs—massive wrought iron T-shaped beams, which are made in joints about five feet long by two deep, up to where the armour plates begin, five feet below the water line. These beams are only 3 feet 8 inches apart, while, for a distance of 10 feet on each side of the keel, they are bolted in at only half this distance asunder. Five feet below the water-line the armour plates commence, and, to give room for these, the depth of the rib diminishes to about half, or nine inches. Over the ribs, and crossing transversely, are bolted beams of teak a foot and a half thick, and outside these again come the armour plates. Each of these plates is to be 15 feet long by 4 feet broad and 4½ inches thick. Several of them have been made by the company of puddled iron, of annealed scrap iron, and of scrap iron unannealed, and experiments are now being made at Portsmouth with a view of testing practically which best withstands the tremendous attack of 68-pounders. It is almost needless to say that each plate is the very perfection of material and manufacture. These ponderous slabs go up to the level of the upper deck. The orlop deck will be of wood, and 24 feet above the keel. The main deck will be of iron, cased with wood, and 9 feet above the orlop. The upper deck will also be of wrought iron, and 7 feet 9 inches above the main. All the decks are carried on wrought iron beams of the most powerful description, to which both the ribs and iron decks are bolted; while along the whole length of the vessel, from stem to stern, are immensely solid wrought iron beams at intervals of five feet inside the ribs, which are again crossed by diagonal bands, tying the whole together in a perfect network. The armour plates are not intended to shield the whole vessel, only the fighting portion, about 220 feet of the broadside, being thus protected. This broadside, however, will mount 14 of the Armstrong 100lb. guns, which, with two broadside guns on the upper deck and two pivot guns of the same kind forward and two aft, will give her a total armament of 36 guns, each throwing a 100lb. shot over a range of nearly six miles. Neither the bows nor stern have any of the large armour plates, but are coated with wrought iron plates of nearly one inch and a half thick over two feet of teak, which will offer sufficient resistance to prevent most shots from going through. But to compensate for this apparent deficiency both bows and stern are so crossed and recrossed in every direction with water-tight compartments that it is a matter of perfect indifference whether they get riddled or not, and each of these ends are shut off from the engine-room and fighting portion of the ship by continuous massive wrought iron transverse bulkheads. So that, supposing it possible that both stem and stern could be shot away, the centre of the vessel would remain complete and impenetrable as ever, still offering in all 24 inches of teak coated with 5 inches of wrought iron to every shot. But both stem and stern are built inside of such immense strength that coating with armour plates would be almost superfluous. The bows, as the spot where the whole shock must be received in running down ships, are inside a perfect web of ironwork, strengthened back to the armour plates with no less than eight wrought iron decks an inch thick, and crossed and recrossed in all ways and methods with diagonal bracings and supports. In the design sent into the Admiralty by the Thames Shipbuilding Company the shape of the bows was made exactly after the outline of the neck and breast of a swan when swimming. Thus the point which would strike an enemy's vessel was the "breast," which was placed under the water line. In the Admiralty model, according to which the "ram" is to be built, the bows form an obtuse angle, the point of which is just level with the water, receding back at a rather sharp slope both above and below it. This peculiar shape, however, will be concealed under the usual figurehead and forward gear with a light artificial cutwater of wood, so that apparently the vessel will be an ordinary frigate of the largest size. The Admiralty, no doubt, intend by these devices to disguise her real character, but we need hardly point out how utterly futile such an attempt would be. Could any naval officer be deceived by any amount of painting about the character of a ship of 6,000 tons, nearly 400 feet long, rigged like a three-decker, yet only carrying a broadside of 14 guns on her main deck? Or do the Admiralty suppose that there will not be perfect photographs of her, when finished, taken for all the foreign powers, which will be reproduced and distributed among their navies, with strict injunctions in case of war always to avoid such a vessel if they can? The very idea of attempting to conceal the real purpose of a vessel so remarkable, and the only one of its kind afloat, seems absurd. Coming up into action with other first-rates in line of battle, no doubt she would pass muster unobserved, but under such circumstances, even if as well known to the enemy as to the English, the knowledge would avail nothing to the former. Once a general engagement was commenced, the "ram" would be able to pursue her mission of destruction by running into the sterns of the enemy's vessels almost without hindrance. When such is avowedly her purpose it seems, to say the least, unwise to cumber her with the masts and rigging of a line-of-battle ship. The shock of striking the first vessel would bring down all her masts by the board like reeds, and leave the ram's decks so encumbered with wreck as might even render her almost useless for further efforts. The mode in which she attacks will be to run straight at the enemy, taking him, if possible, in the stern or quarter, all the men on deck retiring to the stern to avoid injury from falling spars. When about half the vessel's length from the enemy the engines are to be stopped, and the engineers' stand by to reverse the engines in order to clear her from the wreck of her antagonist before the latter goes down. It is calculated that striking a line-of-battle ship in the stern the ram would sink her within three minutes. The bowsprit will, we believe, be telescopic in order to be housed on board with the anchors before striking the enemy, that there may be no chance of becoming entangled with the wreck of the sinking vessel. It is, however, yet to be explained how she is to get rid of her own wreck of masts and spars, and above all what precautions will be adopted to prevent any chance of the rigging fouling her screw. The cost of the hull will be about £200,000, the engines about £75,000, and her fitting for sea about £45,000 more—or £320,000 in all. If she only does one-half of what may be fairly anticipated from her she will be cheaper to the nation than a dozen sail of the line, and we hope before long to announce that another of the same kind has been decided on.

CLIFFORD'S SYSTEM OF LOWERING BOATS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN:—I must beg space in your columns for a reply to the objections urged by "Nauticus" against my system of lowering boats, as they are evidently made by one who does not understand the principles of the system, or know how to work it properly. Before answering these I would remark that the impression evidently intended to be conveyed by the report in the *Times* could only be that the "*operation*" referred to as requiring four men was that of the "system of lowering invented by Captain Kynaston" mentioned in the sentence immediately preceding, and not the disengaging hook only, which would be simply ridiculous. Four men is certainly no over estimate when he himself admits that the *usual number* are required on board to lower, with one man to disengage; printed directions furthermore stating, that "the foremost disengaging fall may be kept handy; but it should only be used as a resource to provide against the extreme possibility of the aftermost line being foul, which latter is hardly possible." This would involve the necessity of the presence at least of a second for disengaging. "Nauticus" further states, "whether the men lower simultaneously or not, directly the disengaging line is let go the boat *must enter the water on an even keel.*" What is to prevent one fall going, with a run? a common consequence of lowering by the falls, which no system of disengaging can remedy. To the first objection, that the length of the pendants cannot be suited to light and heavy draughts, the reply is, they are adjusted so as to enable the boat to reach the water when the ship is laden, but extra rope is allowed for light draughts, as my printed directions explain. In men-of-war the difference in draught with coals or without is so slight as to be of no consequence in this matter, and the additional rope on the roller could not lead to accident. In a line-of-battle-ship the extreme variation of draught would be 20 inches; in ships of the "Diadem" class, 2 feet; and in gun-boats 6 inches. From the way in which the boat hangs, by my system (the points of suspension head and stern being above the boat's gunwale, from which steadying lines to the boat's sides are attached), she would not be swamped as a boat is ordinarily under such circumstances, if the water were moderately smooth, and if rough, the fall of the wave would at once clear the pendants. "Nauticus" cannot tell me of any instance of a boat "having been swamped and her crew probably drowned," nor can he produce the instance which he "fears might be cited."

One of the chief features of my system of disengaging, and to which I attach very great importance, though the one least understood till seen in actual operation, is that when the boat is lowered, steerage way is not only put upon her directly she touches the water, but is retained for several seconds after she is floating by a gradually yielding strain without any sudden check or additional act of any one to release the boat. This enables her to be sheered clear of the ship, and out of the suction of the screw. The loose tapered end of the pendant as it is overhauled through the three sheeve blocks accomplishes this end, either by the strain caused by the way of the ship, or if at anchor, as the boat falls with the wave or is drifted away. Without some such provision, lowering a boat from a screw steamer under way, especially on the weather quarter in a heavy seaway, would be a dangerous experiment, the wind and draught of the screw carrying the boat directly on to the latter. But this I have repeatedly done on public trials.

As to the boat being stove against the ship's side, the celerity obtained by lowering with single pendants is the best possible prevention to such a casualty; for when lowered and disengaged at the same time by one hand only, advantage can be taken of the roll of the ship, and the boat be dropped on the water *clear of the ship* in a *few seconds* after the word of command is given to "lower away," if the gear is only kept in the same condition as the rest of the running gear of the ship. This cannot be done where the combined action of several men is required, as in lowering by the falls.

As to the stiffening of the pendants, the same causes that would prevent their working would operate against the falls; and if the pendants, from being of stouter rope, offer greater resistance to a free run, the direct action of the weight of the boat on the pendant or the single part of rope only that they involve, in place of the four parts of rope used in the falls, is a proportionate power to overcome such resistance.

The "vibration" complained of in lowering could only arise from the gear being improperly rove,

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and the pendants being passed round the sides or cheeks of the blocks, preventing a fair and even run. This would account for "sundry of the crew" being required to overhaul the pendants and for ropes being cut. Cases can be substantiated where this has happened. Rope, moreover, has been supplied from one yard of a character contrary to my printed instructions, and it is this cause, and not the nip on the rope, that has led to their breaking. The attention of their lordships will be officially directed to this point, as it is *only* with the rope in question that any fracture has ever occurred. After three years (compulsory use) in all Government emigrant and transport ships no single case of rope breaking has been reported to the authorities.

My plan does not pretend to do more than lower evenly and safely and disengage at the same time, *by one man*, and I cannot help drawing attention to the testimony "Nauticus" bears to its efficiency, in the facility which he says it affords for suddenly leaving a ship—the very purpose for which it was intended—and which has been officialy declared a "*desideratum wanted throughout the naval service.*" This very admission is the best contradiction to the objections that have been previously urged. The occasional abuse, however, of a public good cannot be urged as a reason for its suppression. Besides, in times of danger, when the power of lowering is in the hands of one person, any trustworthy man ordered to the command of such a means by the captain or officer on watch, in having the entire control of everything connected with the lowering and disengaging in his own hand, can stop desertion and prevent the mischief arising from hurry and confusion, or take advantage of the instantaneous action that such a system would afford to escape at the proper moment.

As to a stopper being necessary for taking the strain off the pendants when the boat is hanging at the davis heads, "Nauticus" must know something of the kind is always used to relieve the falls.

Written correspondence must always be an unsatisfactory way of solving the mechanical objections urged in favour of rival inventions, and I know I have already trespassed on your indulgence; but if "Nauticus," or any officer in Her Majesty's service, will tell me of any position, either by day or night, from a ship at anchor or under way, from the lee or weather side, in smooth water or a heavy rolling sea, when a boat fitted with my plan could not safely be lowered, I will myself attend in person, and try it against any other system or invention that can be brought against it for effecting a like end. It is after such times and occasions that judgment should be passed, and it is such practical tests that "Nauticus" should endeavour to bring about, as well for the public good as to settle the question of the competing ideas of himself and

Yours obediently,

C. CLIFFORD.

Temple, June 20, 1859.

RIFLES FOR VOLUNTEER CORPS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—At a numerous meeting held by the gentry of Sussex at the Hayward-heath station, on the 22nd inst., Lieutenant Busk, of the Victoria Rifle Corps, read a most lucid paper on the properties of the rifle, which was received with reiterated plaudits, and most deservedly so. I had the happiness to be present, and can safely say that the enthusiasm manifested by the gentlemen composing the meeting will find an echo throughout all England. The choice of the proper rifle for volunteers is now a matter for grave consideration. I do not hesitate to prefer the Lancaster muzzle-loader to the Enfield. A most clear description of the practical results of both weapons, as evinced from their use in the late war in India, appeared recently in the *Times*. It was written, I believe, by Sergeant Sturrock, of the Royal Engineers, than whom a more perfect master on the subject of the rifle, and its now various missiles, I never conversed with. In support of my preference for the Lancaster rifle as a military arm, I will state that I lately met a sergeant of the 96th Regiment, now stationed at Plymouth, who informed me that he had fired forty rounds in succession from the Lancaster rifle, using pure suet or tallow for the lubricating matter, without finding the slightest inconvenience from loading. The sergeant had received honours and increased pay for his excellence as a marksman, and therefore must be a good authority on the superior efficiency of the Lancaster rifle.

As regards breech-loading rifles, I have a high opinion of that invented by Mr. Leetch, of 68 Margaret-street, Regent-street.* As a proof that I think well of it, I have ordered one to be made for me, to use when I become a guerilla, in conjunction with some hundreds of thousands of the "bone and sinew" of the land. It is a source of pride to me in my advanced stage of life, to be able truly to say that as far back as the year 1823, I had perfected my elongated rifle shot and shell, and thus evoked "the strength that slumbered" in a rifled arm. I am, Sir, yours, &c.,

J. NORTON.

Rosherville, June 25.

UTILISING THE MILLIONS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—As it appears there is no use now made of the fifty millions of iron cups for inserting in the hollow base of the Minié rifle shot, which were manufactured by Mr. Greenfield by order of the War Department, I make use of them in forming the head and front of my elongated rifle shells. I am, yours obediently,

J. NORTON.

Rosherville, 29th June.

Proceedings of Societies.

THE GEOLOGICAL SOCIETY OF LONDON.

June 15.—Prof. J. Phillips, President, in the chair. Special General Meeting. It was resolved that persons proposed after November 2nd, 1859, for election as Non-resident Fellows of the Society should pay an entrance-fee of £6 6s., and an annual subscription of £1 11s. 6d. Ordinary General Meeting. Major W. E. Warrand, Bengal Engineers, Westhorpe, Southwell, Notts, was elected a Fellow. The following communications were read:—1. "Notes on Spitzbergen." By J. Lamont, Esq. Communicated by Sir C. Lyell, V.P.G.S. 2. "On the Formation of Gypsums and Dolomites." By T. S. Hunt, Esq., of the Geol. Surv. Canada. Communicated by Prof. A. C. Ramsay, F.G.S. 3. "On the Tertiary Deposits, associated with Trap-rocks, in the East Indies." By the Rev. S. Hislop. With descriptions of the Shells by the Rev. S. Hislop; and of the insects by A. Murray, Esq. Communicated by the President.

ROYAL AGRICULTURAL OF ENGLAND.

June 22.—At a Special Council, his Grace the Duke of Marlborough, President, in the chair. The report of the Special Committee appointed to examine the past accounts of the Society was read, received, and confirmed. It was moved by the Hon. Col. Hood, and seconded by Lord Berners, "That Mr. Hudson be dismissed from the office of Secretary." On the motion of Mr. Brandreth, seconded by Col. Challoner, it was resolved, "That a Committee be appointed consisting of the President, Vice-presidents, Trustees, and the following members of the Council:—the Hon. Col. Hood, Mr. Barnett, Mr. Jonas Webb, Mr. Wren Hoskyns, Mr. Torr, Mr. Fisher Hobbs, Mr. Milward, Mr. Brandreth Gibbs, Mr. Amos, and Mr. Brandreth, to take into consideration and report to the next general Council what in their opinion should be the general and particular duties of the secretary and the mode of his appointment." Col. Challoner, Chairman of the Implement Committee, presented the report recommending the judges of implements for the Warwick Show. Mr. Milward, Chairman of the Live Stock Judges Committee, presented the report recommending the judges of live stock, cheese, and wool. These reports were received and confirmed. Mr. H. S. Thompson, Chairman of the Journal Committee, reported the recommendation that the Prize of 25 Sovereigns for the best Report on the Agriculture of the Islands of Jersey, Guernsey, Alderney, and Sark, be awarded to the author of the essay bearing the motto "Practical." The sealed envelope having been opened by the President, the author was declared to be C. P. Le Corme (Honorary Secretary to the Royal Jersey Agricultural Society), Beaumont, Jersey,

* Described and illustrated in our last number.—EDS. *M. M.*

Law Case.

COURT OF QUEEN'S BENCH, Westminster, June 25.—(*Sitting at Nisi Prius, before Mr. Justice Hill and a Special Jury.*)

DOULTON *v.* STIFF.

Mr. Bovill, Q.C., Mr. Lush, Q.C., and Mr. Webster appeared for the plaintiff; Mr. Knowles, Q.C., and Mr. Hindmarch for the defendant.

The plaintiff in this action, Henry Doulton, was one of the partners in the firm of Doulton and Co., of the Lambeth Pottery Works, and he sued the defendant, James Stiff, also a Lambeth potter, to recover damages for the infringement of a patent granted to the plaintiff on the 11th of May, 1854, for "improvements in kilns used in the manufacture of stoneware, earthenware, and china," and described in a former volume of the MECHANICS' MAGAZINE. The defendant pleaded several pleas, denying the infringement, and also the novelty of the plaintiff's invention.

The object of the plaintiff's invention, as described in his specification, was so to arrange the fireplaces or furnaces of kilns used in the manufacture of stoneware, earthenware, and china, as to prevent as much as possible the evolution of smoke into the atmosphere. For that purpose, over each fireplace or furnace, a fire-tile or thick plate, perforated with numerous holes, was placed or fixed, and over that a chamber was formed to receive air, there being a slide or other means of regulating the flow of air into the chamber. By that arrangement the perforated tile or plate became highly heated by the fire below, and the draught of the fire being inward to the kiln, the air would pass down through the perforations and become still more highly heated than when in the chamber above; and the heating of the air in the chamber might be assisted by having perforated or other plates or surfaces in the chamber, so that the air might become heated by passing in contact therewith. By such means of obtaining a supply of heated air to that class of flues, it was stated the fuel would be better burnt and the evolution of smoke into the atmosphere prevented. The plaintiff then described the arrangements by which he effected his object, and stated that by those arrangements the perforated tiles would become highly heated, and the atmospheric air would become heated in passing from the chamber downwards through the perforated tiles into the upper part of the furnace or fireplace, and would enter above the fuel therein, and thence pass into the kiln through the opening, where it would meet with the products passing off from the fuel, and become ignited with them as they entered the kiln. The parts of the kiln and the parts of the fireplaces or furnaces shown by the drawings were similar to those in ordinary use, and the novelty consisted in the application and arrangement of the parts shown and described for admitting and heating the air.

Several witnesses were examined on the part of the plaintiff, to show the novelty of his invention, and its infringement by the defendant. According to their testimony the effect of the invention when it had been adopted had been, by producing a more perfect combustion, to abolish smoke, and so to do away with the nuisance which was formerly caused by the Pottery Works.

On the part of the defendant several witnesses were called, who did not deny that by the plaintiff's method smoke was prevented; but they said there was no novelty in his invention, and that the same arrangements were already in use, and were shown in Ferguson's patent of 1853, which had been abandoned. They also went so far as to say that even with the old Staffordshire kiln it entirely depended on the fireman whether or not there should be any smoke.

Mr. Knowles and Mr. Bovill having addressed the jury for their respective clients,

The learned Judge summed up, and said there were two points for the consideration of the jury—first, whether the defendant had infringed the plaintiff's patent; and secondly, whether the plaintiff's invention was new. Both those questions would require to be answered by the jury. The first question, in fact, involved the second. The plaintiff's patent was not for one machine, or a single arrangement, but for a combination. There was no doubt that the defendant had not used all the combination put forward by the plaintiff, but it was alleged by the plaintiff that the

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defendant had used a portion of the combination, and he had to tell them that in point of law, that might be the case if the part of the combination was new and material. If the defendant had used an immaterial part of the combination, then the defendant had not infringed the patent; if he had used that which was not new, it was no infringement of the patent. The jury must be satisfied that the defendant had used a part of the combination which was invented by the plaintiff, and which was new and material. The learned judge then proceeded to read over the whole of the mass of evidence. Mr. Carpmael had stated that, in his opinion, it was impossible for the old Staffordshire kiln to consume the smoke, and yet there were three witnesses who had tried the experiment, and they positively swore that it did consume the smoke. That was a fact against scientific opinion. The plaintiff appeared to put great stress on the perforated tiles, and those the defendant had not used.

The jury retired for some time, and then said the defendant had infringed the patent, but that the combinations used by the defendant were not new.

The Judge: Then this is a verdict for the defendant.

Our Weekly Gossip.

We have frequently given a word of commendation to the *Photographic News*, and had both hoped and heard that its success as an organ of photographic science and art was assured. We now fear, however, that it must be otherwise. We judge so from the fact that its managers are beginning to nibble at subjects on which it has not the shadow of a claim to speak, and which its title in no way includes—a sure sign, we presume, of a want of success in its own sphere. For example, in its last number the greater part of a page is devoted to gossiping remarks on a method of ventilating public buildings, and especially hospitals—a pretty topic for elaborate treatment in a "Photographic" journal! With how little sense the subject is treated may be inferred from the fact that while the person of the inventor himself is minutely described, not a word affording any clue to the nature of the invention itself is given. We venture to recommend "Photography" rather than "Ventilation" to the attention of the editor.

This week's Number of *All the Year Round* contains an article entitled "Change for Nuggets," upon the processes of money-making at the Royal Mint. The account which it gives of the several processes is, as might be expected, very meagre, as compared with the elaborate articles on this interesting topic now in course of publication by ourselves. This will be seen on comparing the following description of the weighing-room with the account of the same apartment given in our last number. The close resemblance between some of the reflections in this week's article of *All the Year Round* and our last week's article will also be apparent. The writer says:—"From the noise and clatter of the cutting-room I was conducted to the elegant calmness of the weighing-room, a department handsomely fitted up, and looking like a show-room for elaborate chronometers. Here is performed one of the most interesting and delicate operations throughout the whole Mint. Upon the counter, on ornamental iron stands, is a silent council of thirteen automaton balances, who pass judgment, individually, upon the work in the foregoing departments, and decide with unerring exactness upon the weight of the golden dumps. These automaton judges sit under glass cases, to preserve them from damp and dust, and they have the appearance of being a row of French skeleton clocks. The golden dumps that are passed into the weighing-room, still looking like the aforesaid Irishman's brass button, are distributed amongst the balances, passing down a receiving slide on to a strip of steel. This strip of steel is made to advance and recede at certain intervals, perhaps of a quarter of a minute, and at each advance it pushes a blank on to a beautifully poised scale table, sensitive to the slightest variations of weight. For a few seconds the machine appears to reflect, and then the golden dump is gently pushed off the scale by the arrival of another piece on the steel slide for judgment. The first, if "heavy," disappears down the outer one of three flattened tubes; if "light," down the inner one; and, if quite correct in weight, down the centre compartment. By careful manipulation much of the work is now made to fall in the medium boxes, thereby effecting much saving in the annual expenses of the Mint—a reform that is attributable to the present working master and his superintendents."

The Government return of "gold, silver, and copper monies of the realm" struck at the Mint during the year 1858 has been published. It shows that of sovereigns there were coined 803,234, representing, of course, an equal value; of half-sovereigns, 855,678, value, £427,789 5s. 9d.; where the 5s. and 9d. are here obtained to us, however, does not appear; of florins, 2,239,380 — value, £223,938; of shillings, 3,108,600—value, £155,430; of sixpences, 1,933,480—value, £48,312; of groats, *nil;* of threepences, 1,445,928—value, £18,074 2s.; of Maundy monies, consisting of silver fourpences, threepences, twopences, and pence, and distributed by Her Majesty's almoner on Maundy Thursday to certain pensioners at the Almonry, Westminster, 20,988; value, £193 11s. 6d. Of copper monies, there were struck, of pence, 1,559,040—value, £6,490; of halfpence, 2,472,960—value, £5,152; of farthings—neglected farthings—1,720,320—value, £1,792. In addition to these items, and which do not figure in the return alluded to, we are in a position to state that the Mint produced during the last year 15,000 Persian, Indian, and Kaffir medals, and rather over four millions of 20-cent., 10-cent., 5-cent. silver and one cent. bronze coins for Canada. In another part of our journal will be found a note on the workings of the Mint at present. All tends to prove that that place requires expanding if it is to keep pace with the demands made upon it. Why not have a second exclusively *copper* mint, like Calcutta is doing?

Mr. B. L. Phillips writes:—"Your readers may remember some particulars were given in July and August, 1854, relative to my discovery for purifying iron. I have not till recently had an opportunity to make further trials at the Monkbridge Works, Leeds (Messrs. Jas. Kitson and Sons); but I now hand you the results of some experiments there in the puddle-furnace. The effect produced on the metal appears astonishing. Part of the experiment No. 2 was made into ½ and ¾ in. rods, and submitted to most severe tests, by bending, twisting, and tying into the treble knot, all of which it stood without the least deflection, and it was pronounced fully equal to the wellknown make S. G. The metal made by this process when struck vibrates like steel, thereby showing its purity and strength. For rails, electric wire, springs, chain cables, and indeed for all work requiring good, sound, and pure metal, I think this make will prove invaluable, and be an ultimate saving of 15 to 25 per cent., from its superior tenacity and durability. Not being practically engaged in the trade, I labour under every disadvantage, in not being able fully to carry out the required experiments in the puddle and blast-furnace, and also in the make of steel, but I am willing to treat with any respectable firm for that purpose, and call the attention of the trade to the following particulars, being convinced that my invention will prove the most important discovery of our time, should its further development carry out the facts which the specimens indicate." We do not think it necessary to publish the results of experiments.

CAPTAIN KYNASTON'S DISENGAGING HOOKS.—The *United Service Gazette* says:—"The Cadmus, 21, screw, Captain Hillyar, made a trial trip outside Plymouth Sound on Monday. Her engines, which are by Penn, worked admirably, and the speed obtained was 11¼ knots. The first cutter fitted with Kynaston's life-hooks was lowered while the ship was going nine knots, having besides her proper crew, Admiral Kingcome, and Mr. Ward, Assistant to the Chief Engineer at Keyham; and subsequently when going ten knots, the other cutter with two lieutenants and some young ladies, in all sixteen persons. The process of disengaging was so simple and easy, that the party could scarcely believe they were clear of the ship until they saw her a hundred yards away from them. The Cadmus sailed on Wednesday for the Mediterranean. The Curacoa, 31, screw, Captain Mason, at Plymouth, has had her quarter-boats fitted with Kynaston's life-hooks, in lieu of the patent boat-lowering gear previously in use."

NOTICES.

The letters of Mr. Baker (Inland Revenue Department), and of Mr. J. P. Drake, are unavoidably left over until next week, as are the notices of several publications also.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 2624, 2625, 2634.
BOILERS AND THEIR FURNACES, 2641.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2597, 2605, 2637.
SHIPS AND BOATS, including their fittings, 2596, 2627.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2607, 2635.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals. *None.*
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2599, 2603, 2606, 2611, 2612, 2614, 2618.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c. *None.*
LIGHTING, HEATING, AND VENTILATING, 2604, 2613, 2632.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2598, 2608, 2609, 2615, 2623.
METALS, including apparatus for their manufacture. *None.*
CHEMISTRY AND PHOTOGRAPHY, 2600, 2622.
ELECTRICAL APPARATUS, 2601, 2616, 2626.
WARFARE, 2619, 2631, 2633.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 2610, 2613, 2617, 2618, 2620, 2621, 2627, 2628, 2629, 2630, 2636, 2638, 2639.

2596. H. DOUGLAS. ***Improvements in screw propellers.*** Dated Nov. 17, 1858.

Here the inventor forms the advance edge of the propeller blades of a convex curved form so that the curve of the edge of the blade at the extreme end or periphery will be in the rear (as regards its position in the screw) of the inner termination of the curve, or that next the centres the curve is such that it produces an easy cleaving action in the water. The leading edges of the propeller blades are sharpened or serrated so as to clear the propeller from cordage, &c. *Patent abandoned.*

2597. W. CLARK. ***An improved bit or bridle for horses.*** (A communication.) Dated November 17, 1858.

This bit is composed of a system of levers terminated by spoonbills or blades, which, by suitable reins, will approach and close the nostrils of the horse and suspend his respiration, and thus compel him to obey. *Patent abandoned.*

2598. S. RILEY. ***Improvements in the manufacture of hats, bonnets, and caps.*** Dated November 18, 1858.

This consists in the application of any kind of elastic material to any part of the body or brim, either outside or inside of either hats, caps, or bonnets. *Patent completed.*

2599. C. COWPER. ***Improvements in assorting and separating combed fibres, and in machinery for that purpose.*** (A communication.) Dated November 18, 1858.

This invention is similar to those formerly patented by Mr. De Jongh. The present invention, however, is adapted for operating on fibres, when in the form of a sliver or band, instead of being in separate stricks or bundles. One or more slivers of combed fibres are fed into the assorting machine by a feeding apparatus composed of a gill or porcupine roller, which brings forward and delivers such fibres, so that their projecting ends may be lashed into a travelling comb, where the ends of the fibres so lashed are held by a suitable apparatus, so that, by the back motion of the feeding apparatus, the fibres so held or nipped shall be drawn through the teeth of the feeding apparatus and detached from the sliver and left in the travelling comb. The travelling comb or holding surface will then carry forward such detached fibres, the projecting ends of which should be supported and held up in their proper position by suitable holders or guiders, until the needles of one or more travelling combs working parallel to, and at the same speed as, the first-mentioned one, enter the projecting ends of the fibres, so as to leave projecting beyond the outermost travelling comb a length of the said fibres sufficient to be taken hold of by the first drawing-off or nipping apparatus, after which, as the travelling combs go forward, the outermost travelling comb goes away from and leaves the fibres, and so presents a fresh projecting end ready to be taken hold of and drawn off by a second drawing-off or nipping apparatus, which is set nearer to the first-mentioned travelling holding comb, into which the fibres were lashed, and so on for each travelling comb, of which there may be one, two, or more, till the shortest fibres are drawn off from the first travelling holding comb. *Patent completed.*

2600. E. BRIOLLET. ***The obtaining of caloric by a new chemical and mechanical process.*** (A communication.) Dated Nov. 18, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2601. SIR C. T. BRIGHT. ***Improvements in insulators, and an improved mode of connecting insulators to posts and other supports.*** Dated Nov. 18, 1858.

This invention was described and illustrated at page 364, No. 23, of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

2602. J. and H. SHARP. ***Improvements in Jacquard machines employed in weaving.*** Dated Nov. 18, 1858.

This relates to working the cylinders or producing the oscillating motion thereof required in jacquard machinery, and the improvements consist in causing the cylinder to

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beat up the cards thereon, to act upon the needles at such time only as they are free to move, or when the "grifes" or lifters have not hold of the hooks. *Patent abandoned.*

2603. H. STOTT. *Improvements in warping mills, or apparatus connected therewith.* Dated Nov. 18, 1858.

This consists in the use of a heck or apparatus for separating or "taking the lays" at the tail end of the warp. It is formed similar to the heck now in use for taking the lays at the head end of the warp, but instead of having eyes or holes for the threads to pass through, forks or slots open at the top, so that the separate lays can be lifted out at the openings thereof, are employed. *Patent completed.*

2604. J. LESLIE. *Improvements in the manufacture of gas.* Dated November 18, 1858.

This consists in subjecting mineral bituminous matters to distillation at low temperatures to obtain the products distilled over in a condensed liquid form, and then to subject such liquids to processes of purification, in order to fix or remove the ammonia, sulphur, &c., and then to subject the purified liquids to destructive distillation, by which a very pure gas is obtained. *Patent completed.*

2605. J. OAKES. *Improvements in the manufacture of spurs.* Dated November 18, 1858.

This consists in manufacturing spurs by striking or stamping them into form in suitable dies. *Patent completed.*

2606. J. M. MILLER and J. FEAR. *Improvements in machinery for winding fibrous substances or materials when in the form of thread or yarn, on to the bobbins or wheels used in lace machinery.* Dated November 18, 1858.

The object here is to enable a number of bobbins or reels to be wound at one time independently of each other under the superintendence of one person, so that each may be equally filled, that the thread or yarn may be kept steady while being wound on, and be readily cut, and that the reel may be prevented from overrunning. The patentees employ a revolving knife for cutting the thread, &c., at the proper time. They prevent overrunning by effecting the stoppage of the reel by pressure on the reel itself when the thread, &c., is cut or broken, and they keep the thread, &c., in a constant state of tension, steady it and prevent vibration by a peculiar contrivance. We cannot afford space for the details of the invention. *Patent completed.*

2607. D. STOTEN. *Improvements in ploughshares.* Dated November 18, 1858.

This consists in the application of hardened steel to the points of ploughshares. *Patent abandoned.*

2608. E. T. ARCHER. *Improvements in hat ventilators, and appliances connected therewith.* Dated Nov. 18, 1858.

This consists in a method of making and fixing a brass ventilator in hats, in connection with which is a steel spring for holding railway tickets, cards, &c. *Patent completed.*

2609. B. RIDER. *Improvements in ventilating hats and caps, and in the preparation or manufacture of the material of which those articles are made.* Dated November 18, 1858.

This consists in ventilating hats, &c., by perforating the bodies before the silk or other covering is applied. The covering hides the perforations, but permits of the passage of air. It also consists in combining with paper, while in a state of pulp, long fibres of any fibrous material, or fibres or threads of cork for the production of material for the manufacture of hats, &c. *Patent completed.*

2610. P., E., and J. MARCHAND. *A new process for refining lamp oil.* Dated November 19, 1858.

The inventors take ten hectolitres of the oil of sessame, or linseed, or any other sort, which, being clarified, is poured into a boiler heated by steam or hot water. When heated to 75°, 5 per cent. of alkali at 28°, mixed with one-third of salt, is poured in, and a pale oil, without smell or taste, is the result. This oil is next mixed with a certain quantity of waste or cake of native rape seed, turnip seed, or mustard seed of China, the whole put under the stampers, and subsequently submitted to the hydraulic press. The oil thus produced is boiled with ½ per cent. of sulphuric acid and 10 per cent. of water; and, after being left to stand, is passed through a filter of charcoal or sawdust. *Patent abandoned.*

2611. J. BROWN. *Certain improvements in index and Jacquard machines.* Dated November 19, 1858.

The object here is to dispense with the weights and springs in index and Jacquard machines to draw down the heads or harness. For this purpose the inventors make use of two grifes, one of which raises the hooks up and the other depresses them. These grifes act upon a double hook of an improved shape, or upon two hooks of the usual shape: the hooks are connected to top and bottom jacks. It also consists in a mode of turning round the Jacquard cylinder. To the Jacquard cylinder is fixed a bevil-wheel, gearing into another bevil-wheel, loose on a shaft, which is driven by the crank-shaft or tappet-shaft of the loom. This wheel has catches taking into a catch-box fixed on the said shaft, and sufficient play is left between the catches to allow the cylinder to be moved from the needles before it is turned round. There are modifications included. *Patent abandoned.*

2612. W. S. HAYWARD. *Improvements in the manufacture of a glutinous and viscous substance or doctrine to be used in the manufacture of paper, and in dressing textile fabrics, by which greater tenaciousness, smoothness of surface and body are obtained.* Dated November 19, 1858.

Here the patentee first subjects the starch to the action of a weak solution of nitric or nitro-sulphuric acid, sprinkling the latter over it; the strength of this solution will vary and depend upon the quality of the starch used; generally a useful preparation will be one of acid to 25 of water, and the quantity of solution used may be about an eighth or tenth of the mass of starch operated upon. He then subjects the whole mass to the action of heat, and this preferably by an arrangement so that an equable temperature may be maintained, as by a sand, air, or steam bath. He continues the action of the bath until the liquor is evaporated, and so long as no change takes place in the colour of the resulting product. He then removes it, and grinds it down to a powder. *Patent completed.*

2613. G. HOWE and J. NORTON. *An improved method of boiling water or worts for breweries, distilleries, &c., by steam, or for heating rooms, public buildings, churches, chapels, factories, &c.* Dated November 19, 1858.

The patentees fix their apparatus to any ordinary boiler, by attaching an outlet-pipe to the same, with taps and valves, which pipe connects the water or steam with a coil pipe, which coil pipe is introduced into a boiling pan or vat, thereby causing the liquid in the pan or vat to boil quickly. The pipe is then carried from the pan or vat into the boiler, thereby returning any condensed or waste steam. *Patent completed.*

2614. S. C. and J. LEACH. *Certain improvements in the construction of "self-acting temples," to be employed in looms for weaving.* Dated November 19, 1858.

This consists in the use of wooden rollers revolving upon an axis, each furnished with pins or points, and with guards or covers moving upon the same axis. These rollers or temples are mounted at each end of a horizontal bar, which extends across the loom (its upper surface being level with the peripheries of the temples), and is jointed near the middle of its length to be adjustable to the width of the loom, and also at each end for the adjustment of the temples. The horizontal bar is riveted or hinge-jointed upon brackets, so that it may vibrate laterally upon such brackets, which are secured to the framing of the loom. The fabric is distended between the temples, and bears upon the upper surface of the bar, which has the effect of distending the fabric in a direct line across the loom, and of preventing the usual curving thereof, as when any uneven strain is exerted upon the fabric, the temples and bar move laterally, and thereby equalize the tension of the fabric. *Patent abandoned.*

2615. J. EDWARDS. *Improvements in the manufacture of trouser buttons.* Dated November 19, 1858.

This relates to the use of prepared paper, &c., to the manufacture of trouser buttons, so arranged as to form the front of the buttons, or placed between the back and front after the front has been ornamented by piercing, so as to allow the paper to show through the opening, and for colouring the same in the way that steel pens are coloured. *Patent abandoned.*

2616. W. HANCOCK. *Improvements in the manufacture of electric telegraph wires and cables.* Dated Nov. 19, 1858.

This consists in the use, as an insulating material, of a compound composed of gutta-percha, or india-rubber, of a shellac, resin, Venice turpentine, &c. Also, in the preparation of the conducting wire by passing it through a cement composed of asphalte or bitumen, and Venice turpentine, either with or without the addition of shellac, resin, &c. *Patent completed.*

2617. C. F. VASSEROT. *An improved apparatus for condensing and cooling vapours and liquids.* (A communication.) Dated November 19, 1858.

This consists of a cylindrical vessel divided into two portions, an inner and an outer, each possessing nearly the same sectional area. A pair of copper sheets is placed parallel, having a small space between their surfaces; these sheets are then wound spirally within the outer portion of the cylindrical vessel. At one extremity of the said vessel is a series of tubes, communicating at one end with the spaces between each of the convolutions of the copper plates, and with their other ends terminating in a vessel of cold water, which is applied for the condensing purpose. Another vessel serves to receive the condensed liquid. A similar arrangement of tubes and vessels is placed at the other extremity of the apparatus, the tubes serving to carry off the water which has condensed or cooled the liquid, and the vessels to receive the fluid to be condensed and to distribute it between the surfaces of the copper plates. *Patent abandoned.*

2618. H. H. HENSON. *Improvements in waterproofing fabrics or materials.* Dated November 19, 1858.

This relates to a former patent, and consists in the use in connection with any fabric treated with adhesive materials of solutions of chloride of zinc, a mixture of solutions of hydrated protoxide of lead, and sulphate or acetate of alumina, or both, or any soluble salt of alumina, or a mixture of a solution of silicate of soda, or silicate of potash and hydrated oxide of lead, or a mixture of solutions of nitrate of lead, acetate of lead, and sulphate of alumina, or soda, alum, manganese, or any of the double sulphates, or the elements or equivalents thereof, for rendering fabrics surface water-proof by immersion, pressure, or exhaustion. *Patent completed.*

2619. W. RAMSCAR AND J. G. SCOTT. *Improvements in fire-arms.* Dated November 19, 1858.

Here the patentees bore the breech end of the barrel so as to admit a metal case for holding the charge, or to admit any prepared cartridge having its exterior of the same size and shape as the metal case, which latter is furnished with a nipple for percussion caps, and the cartridge with a pin communicating with the explosive compound. Or they make the breech of the same diameter as the barrel, without any recess, so that the cartridge may go with the charge. The case or cartridge is kept in its place by a drop-lid turning upon a joint at the side, and held when required by a locker. In the lid there is a moveable plug furnished with a spring, one end of the plug corresponding with the nipple, or pin, and the other with the hammer. They raise the lid by hand, or cause it to be acted upon by one or more springs, so that it may be lifted immediately after the piece has been fired. When the piece is at full cock, and the drop-lid pulled back, the case or cartridge can be placed in or withdrawn from the recess with great facility. When the charged case with its nipple, covered with a cap, is placed in the recess, and the drop-lid locked, the piece is ready for firing, the hammer striking the plug, which acts on the percussion cap, or upon the pin when the prepared cartridge is used instead of the case. *Patent completed.*

2620. E. A. PONTIFEX. *Improvements in external surface condensers.* Dated Nov. 19, 1858.

This consists in fixing the transverse tubes in surface condensers at one end only, and in uniting the tubes to the steam passages or chambers by means of yielding or expansible joints. *Patent completed.*

2621. H. BAILEY. *Improvements in heating razors.* Dated Nov. 19, 1858.

This consists in inserting the razors in a tube, in which the heat of a small night-light or flame passes when they are to be heated for shaving. *Patent completed.*

2622. W. CLARK. *Improvements in purifying natural phosphates of lime.* (A communication). Dated Nov. 19, 1858.

This relates to a former patent, dated 25th Sept., 1858. For quickening the decomposition of the carbonate of lime, instead of utilizing the action only of but one chemical affinity, two chemical affinities are here developed, which act in the same manner for producing a similar decomposition of carbonate of lime. *Patent completed.*

2623. A. FELTON. *Improvements in fastening buttons and studs to dress and other articles.* Dated Nov. 19, 1858.

This consists in securing the buttons, studs, &c., by a hollow stem projected through the substance to which it is to be fastened, and the edge turned down and spread out in the form of a lip or flange, and in the manner of forming eyelets. *Patent abandoned.*

2624 J. E. F. LUEDEKE. *Improvements in motive power-engines.* Dated Nov. 19, 1858.

Here the inventor employs the power of magnetism to sustain a column or columns of fluid in a chamber or chambers, and above its natural level in a reservoir below. *Patent abandoned.*

2625. W. MARSHALL. *Improvements in steam engines.* Dated Nov. 19, 1858.

According to this invention, as applied for marine purposes in screw propelling, each engine consists of a large and small inverted steam cylinder disposed in line athwart ship. The larger cylinder is inverted upon the top of an open supporting frame, the connecting rod working down direct to the crank or screw propeller shaft. To the piston rod joint there is also connected the inner end of a horizontal lever working upon a fixed centre, the other end of such lever being jointed to the top of a connecting rod working the air-pump bucket or piston. The air pump is disposed on the engine sole plate, or foundation to one side of the keel line of the ship, and directly above it is placed the small inverted steam cylinder carried on a suitable open frame or pedestal. The piston rod of this smaller cylinder is connected to the air-pump lever beneath, so that the piston moves in concert with the air-pump bucket. The steam at its normal pressure is primarily supplied to the smaller or high-pressure steam cylinder, and it is then exported into the larger one in the usual manner of double-cylinder expansive engines. There are modifications included. *Patent completed.*

2626. J. H. JOHNSON. *Improvements in the construction of telegraph cables or conductors.* (A communication.) Dated Nov. 19, 1858.

This consists in covering the conductors with plaited, braided, or interwoven strands of hemp, flax, &c. *Patent completed.*

2627. A. J. THORMAN. *Improvements in chain cables and chains.* Dated November 19, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2628. J. EASTON, sen., and C. E. AMOS. *Improved apparatus applicable to drains, sewers, and water-courses for the purpose of removing extraneous solid matters therefrom.* Dated November 19, 1858.

This invention was described at page 363, No. 23 of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

2629. A. V. NEWTON. *Improved apparatus for transmitting motive power.* (A communication.) Dated Nov. 19, 1858.

This relates to the use of a peculiar arrangement of balance or fly-wheel and cranks for transmitting motion in machinery, and rendering the momentum of the fly-wheel more effective in carrying the cranks past their dead points than when a wheel is applied in the ordinary manner in combination with cranks, whereby, in connection with the use of a load at one point in the periphery of the wheel, the centrifugal force generated in the wheel is rendered available as motive power. The invention is not described apart from the drawings. *Patent completed.*

2630. T. S. CRESSEY. *Improvements in machinery used in the manufacture of casks.* Dated Nov. 19, 1858.

To cut the edges of a stave to the proper curve and bevil, a circular saw-bench is used, on which a bar is fixed longitudinally, and to this bar is applied a flexible template of steel by screws and nuts, so as to admit of the flexible template being varied in its curvature to suit the size and make of cask desired. The wood for making a stave is fixed on a carriage, which is caused to move past the circular saw. This carriage has an arm at each end, to each of which a roller or truck is applied, which comes against the flexible template as the carriage is moved past the circular saw. The upper surface of the carriage is hinged at its inner edge to the bed-plate or frame of the carriage so that it may be made to assume an inclined position according to the degree of bevil desired to be given to the edge of a stave, and the degree of inclination of the upper surface of the carriage is adjusted by a wedge-formed gauge, which is graduated for different sizes of casks; and according as such guage is passed more or less under the upper surface of the carriage in which the wood for a stave is fixed, so will be the degree of bevil produced on the wood when it has been moved past the circular saw. The wood is held in the upper surface of the carriage by its ends in any suitable way, and it is correctly placed in the carriage by the aid of an adjustable stop or stops on the saw-bench, and a spring and adjusting frame on the upper surface of the carriage. *Patent completed.*

2631. R. WARRY. *Loading cannon at the breech.* Dated Nov. 20, 1858.

Here the cannon is cast solid and bored from muzzle to breech through the cascable. Midway between the cascable and trunnions is a conical cylindrical plug or tumbler which is fastened to the left side of the gun by a steel

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plate, through which and the whole breech of the gun the tumbler revolves, having a quarter turn by means of a lever; the shoulder and screw inside prevent it moving to either side. It has an angle protruding through the steel plate to which the lever is affixed; the quarter turn will either bring up the hollow side of the tumbler, which then forms and has all the resisting power of a breech, or leave the gun entirely open. The charge is introduced by the hand, and then placed beyond the tumbler by a flanged ramrod; this completed, the lever in the act of shutting the breech has also the power of cutting the cartridge end by means of the tumbler, and introduces the powder to the nipple, which is placed above the breech on the right hand side. The screw in the steel plate has the effect of easing the revolution of the tumbler, as in the opening of the gun it brings the tumbler slightly out of its bedding from right to left, which in shutting the tumbler it wholly recovers, thereby ensuring the tightness of the tumbler or breech during explosion. An oil hole is introduced at the left rear corner of the breech from the surface, for oiling the tumbler on the bottom side, and which prevents friction and assists in loading. The whole breech of the gun from the trunnions is square-shouldered outside. The bore from cascable to the length of the charge in front of the tumbler is a shade larger than the bore of the fore-reach of the gun to admit the charge easily. *Patent abandoned.*

2632. J. WADSWORTH. *Improvements in gas-burners, and in the means or methods of, and in apparatus for, moderating, or retarding, or governing the flow and pressure of gas used for illumination, and in street lamps or lanterns for shielding flame from the action of wind and rain.* Dated Nov. 20, 1858.

This consists in constructing an apparatus so that the current of gas before issuing from the burner may have its velocity retarded by passing through a tortuous passage. It consists also in the use for retarding the velocity of the gas, of a button or mushroom-shaped stud or deflector, supported only by its stalk or central stem, and not touching the internal surface of the pipe or cavity which contains it. It also consists in the use of the said button or mushroom-shaped deflector as a substitute for a small disc or plate of metal placed transversely across, and dividing an expansion chamber used for rarefying and expanding the gas, and for raising the temperature thereof. *Patent completed.*

2633. C. F. VASSEROT. *Improvements in fire-arms and ordnance, and in the projectiles to be used therewith.* (A communication.) Dated November 20, 1858.

This method of constructing cannon consists in, 1, a base of cast iron, steel, or wrought iron. 2. A case of metal composition composed of 90 parts copper, 9 parts tin, and 1 part lead, cast round the base. 3. Two or more layers of bands or hoops of wrought iron enclosing the above united metals. The hoops are formed with a male and female screw, and screw one into the other so as to form a perfect cylinder; they are put on to the gun when expanded by heat. *Patent completed.*

2634. D. ROWAN and S. ROBERTSON. *Improvements in steam engines.* Dated November 20, 1858.

An engine, or a set of engines, constructed according to a portion of this invention comprises one or more duplex cylinders. Each duplex cylinder consists of an outer annular cylinder combined with a central cylinder or cylindrical space. Pistons working in the central and annular cylinders are connected by their piston rods to a cross head, or to the crank shaft, in such way as to work together. According to one modification the supply of steam to the cylinders is governed by a valve or valves so that the steam from the boiler first enters the central cylinder, next passes thence to the opposite end of the annular cylinder, and finally passes from the annular cylinder into the condenser. Another portion of the invention relates to an arrangement of valvular mechanism specially designed for application to the duplex cylinders, but also applicable to other double-cylinder expansive engines. There are several modifications included. *Patent abandoned.*

2635. H. ELLIS. *Improvements in machinery or apparatus for cultivating, cleaning, and pulverising land.* Dated November 20, 1858.

This consists of a wood or iron frame mounted upon a pair of large wheels the tyres of which are provided with movable teeth or spikes, which are to be taken out when the apparatus is travelling along roads, and inserted when in use on the land for increasing the bite of the wheels. A pair of ordinary draught shafts are fitted to the frame, and the whole drawn by horses; or it may be adapted for traction by steam power. The actual cultivator consists of one or more cylinders fitted with curved spikes and carried in a vibrating frame centred so as to work freely on the main axle as a fulcrum. Suspending chains are connected to the after end of the vibrating frame, and are passed over an overhead roller fitted with a ratchet wheel and detent apparatus and cross arms for elevating the cylinders. A rotary motion is imparted to the cylinders from the running wheels by toothed gearing. *Patent completed.*

2636. C. TOMLINSON. *Improvements in stop taps or valves.* Dated November 20, 1858.

This relates to valves or taps which close by the motion of a valve or plug which is bedded in or removed from its seating, and which is arranged so that the valve or plug opens against the pressure of the fluid the supply of which is to be regulated. That this valve or plug may be removed when required without opening the passage for the fluid the patentee fits another similar valve in combination with the first mentioned, so that it stops the passage when the primary valve is closed, as also when it is removed from its seating. *Patent completed.*

2637. C. CUIT. *Improvements in railway brakes.* Dated November 20, 1858.

The brake is formed of two lever or hollow beams between which the wheels of the vehicle rotate. These beams are united by transverse pieces, forming together with the beams a frame of four sides suspended by rods or chains jointed to the framework of the carriage. This frame is worked by a winch, &c., actuated by the guard, who, when wishing to stop the carriage, lowers the brake frame on the rails so that the beams descend on the rails, and travel thereon on rollers, or small wheels fitted thereto, which are furnished with flanges, and turn on double axles in the beams. When the frame thus rests on the rails its movement of descent brings a number of inclined planes under the wheels of the carriage on which the wheels mount, and so raise the said carriage. The carriage suspended thus on the frame will be rolled on the rail, and stops without shock. *Patent completed.*

2638. W. LEA. *A method of lubricating cocks and taps.* Dated November 20, 1858.

This consists in lubricating the plugs both above and below, or either above and below the liquid way through one or more apertures made in the barrel above and below the liquid way, or either above or below it, which apertures open into a reservoir formed on the outside of the barrel, which reservoir is to be kept supplied with oil, or other lubricating material, and is closed at top by a screw, or other stopper. *Patent completed.*

2639. R. A. BROOMAN. *Improvements in the manufacture of dolls, statuettes, figures of animals, and others, and toys.* (A communication.) Dated November 20, 1858.

This consists in forming dolls and other figures in vulcanized caoutchouc, as follows:—A metal mould of the object to be formed is suitably prepared, and a hermetically closed ball of caoutchouc is placed in the mould, and the parts thereof locked. Thus prepared, the mould is plunged into the hot vulcanising composition. During this operation the air inside the caoutchouc ball is expanded by the heat, and forces the caoutchouc against and into the sides of the mould, and makes it assume the interior shape and form thereof, which form it will preserve after being removed from the mould. It also consists on forming different parts of the figure in separate moulds, and in inserting articulated, wooden, or metal limbs, with the joints placed so as to allow the figure to bend at the knees, elbows, &c. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated March 18, 1859.

686. F. Potts, Tube Manufacturer, of Birmingham. A combined metallic support and label for training, supporting, removing, and transplanting flowers or trees, in gardens or green or hothouses or for other horticultural purposes.

Dated May 31, 1859.

1339. W. Smith, of Salisbury-street, Adelphi. Apparatus for raising and docking ships, and other similar purposes. A communication from J. W. Nystrom.

Dated June 1, 1859.

1350. G. H. and H. R. Cottam, of Old Saint Pancras-road. Improvements in stable fittings.

Dated June 6, 1859.

1381. T. Hyland, of Manchester, Manufacturing Chemist. Improvements in the manufacture of gum or dextrine, and their compounds, from starch.

1383. J. Ferrabee, of Stroud, Engineer. Improved machinery for forming bats of fleece or sheet sliver, and also for folding cloth and other fabrics.

Dated June 7, 1859.

1385. C. Pooley, of Manchester, Cotton Spinner. Improvements in machinery for preparing to spin, and for spinning cotton and other fibrous materials.

1387. P. Salmon, of Glasgow, Merchant. Improvements in valves for pumps and other uses.

1389. W. H. Dorman, of Old Broad-st., and C. Cowper, of Southampton-buildings. Improvements in traction and locomotive engines.

1391. J. Greenfield, of Oxford. Improvements in fastenings for dresses and other like apparel.

1393. F. Muir, of Paisley, Pattern Printer. Improvements in ornamental or colour printing.

Dated June 8, 1859.

1395. C. de Bergue, of Dowgate-hill, Engineer. Improvements in machinery for punching and shearing metal. Partly a communication from M. de Bergue.

1397. J. N. Royer, Tailor, of Paris. Improvements in the manufacture of wadded or quilted fabrics, and in their imitation.

1399. C. W. Eddy, of Kegworth, Leicester, Master of Arts. An improvement in reaping machines.

1401. J. E. Ashby, of Enfield, Bachelor of Arts. Improvements in sights for fire-arms.

Dated June 9, 1859.

1403. G. Bartholomew, of Linlithgow, Edge Tool Maker. Improvements in shoes for horses and other animals.

1404. J. H. Tuck, of Great George-street, Westminster. Improvements in breakwaters, sea walls, and like structures.

1405. E. Welsford, of Bona, Algeria, Proprietor. Improvements in tanning.

Dated June 10, 1859.

1406. T. Greenshields, of Little Titchfield-st. Improvements in purifying gas and obtaining ammoniacal and other salts.

1407. M. J. Haines, of Dursley, Strap Maker. Improvements in the manufacture of driving straps or bands.

1408. G. J. Farmer, of Birmingham, Machinist, and G. B. Hardy, of Brompton, Chemist. Improvements in stair rods and eyes or sockets, which are also applicable for other purposes.

1409. A. F. Haas, of Camomile-st., Merchant. Improvements in lamp and gas shades or glasses.

1410. F. Puls, Chemist, of Haverstock-hill. Improvements in the treatment of hydro-carbons.

1411. S. W. Tyler, of Greenwich, New York. Improvements in harvesters.

1412. W. Sellers, of Philadelphia, Engineer. Improvements in ovens for baking bread or other substances, which improvements are also applicable for drying, annealing, and other analogous purposes.

1413. M. H. Picciotto, of Finsbury-circus, Merchant. Improvements in apparatus for producing or obtaining motive power.

Dated June 11, 1859.

1414. W. Donbavand, of Manchester, Scale-beam Maker, and D. Crichton, of the same place, Machinist. Improvements in looms for weaving.

1415. J. James, of Lambeth, Engineer. Improvements in obtaining and applying motive power.

1416. F. Palling, of Lambeth, Clerk. Improvements in the construction of lamps for the purpose of burning tallow, grease, or oils, either singly or in combination.

1417. T. F. Henley, of Pimlico. Improvements in obtaining alcohol or spirit from rice and other grain, and in apparatus for that purpose.

1418. H. J. Nicoll, Merchant Tailor, of Regent-st. Improvements in trowsers.

1419. A. V. Newton, of Chancery-lane. An improvement in fire-arms. A communication from C. T. Pierson.

1420. F. A. R de Beauregard, of Paris, Civil Engineer. Certain improvements in generating steam, and in apparatus for obtaining power and in generating steam for other purposes.

1421. G. C. Ash, of Hampstead. Improvements in the manufacture of artificial teeth.

Dated June 13, 1859.

1422. B. Baugh, of Birmingham, manager. Certain improvements in apparatus or machinery for raising metals.

1423. H. L. Corlett, of Inchicore, Dublin, Engineer. Improvements in rails, and the permanent way of railways, parts of such improvements being applicable to common roads.

1424. O. Maggs, of Bourton, Dorset. Improvements in washing machines.

1425. A. Smith, of Brixton. Improvements in bleaching and purifying bees' wax.

1426. C. N. Kottula, of Liverpool, Soap Manufacturer. A means of cleansing or purifying the "Thames."

1427. J. T. Smets, of Plaçamen, France, Distiller. Improvements in the manufacture of vinegar from grain and other vegetable products containing saccharine matter, and from a refuse product obtained in the manufacture of starch; also in apparatuses employed therein.

1428. A. V. Newton, of Chancery-lane. Improvements in the fitting of life and other boats. A communication from M. Ludlum.

1429. W. E. Newton, of Chancery-lane. Improvements in the manufacture of piled fabrics, and in the machinery employed in such manufacture. A communication from C. Miller.

Dated June 14, 1859.

1430. G. Smith, of Newington. Improvements in hatbands.

1431. W. Brown, jun., of Selkirk, Manufacturer, and S. Bathgate, of the same place, Engineer. Improvements in machinery or apparatus for carding and treating or preparing fibrous materials.

1432. J. Dixon, of Bishopwearmouth, Durham, Engineer. Improvements in puddling steel.

1433. J. Cowan, of Barnes, Soap Manufacturer. An improved soap.

1434. J. Wansbrough, of Bridge-st., Southwark, Manufacturer, and A. Bain, of Clerkenwell-green, Telegraph Engineer. Improvements in effecting communications between parts of railway trains.

1435. A. MacDonald, of Manchester, Engineer. Certain improvements in machinery or apparatus for punching patterns or devices upon metallic printing rollers or cylinders.

Dated June 15, 1859.

1436. E. J. Maumené, Professor of Chemistry, and V. Rogelet, Merchant, of Reims, France. Using the "suint," or the portion soluble in water of the greasy substance found on the skin and hair of sheep for the purpose of manufacturing potash and other products.

1437. A. V. Newton, of Chancery-lane. Improvements in the manufacture of polishing wheels, sticks, and tools. A communication from T. J. Mayall.

Dated June 16, 1859.

1439. J. Taylor, of Aberdeen, Joiner. Improvements in planes or cutting tools for working in wood.

1440. S. Levy, of Manchester, Cap Manufacturer. Improvements in hats, caps, or coverings for the head.

1441. E. T. Hughes, of Chancery-lane. An improved night-lamp clock. A communication from L. Montanari.

1442. J. Luis, of Welbeck-st. A new syphon meter for liquids. A communication from A. Grenet.

1443. J. Luis, of Welbeck-street. An apparatus for regulating individually the pressure, expenditure, and light in gas burners. A communication from E. Ferguson.

1445. W. Birkmyre, of Port Glasgow, Manufacturer. Improvements in drying, treating, and preparing yarns or thread.

1447. C. H. Waring, of Neath Abbey, Glamorgan, Mining Engineer. Improvements in safety lamps.

1448. C. Wilkinson, of Slaithwaite, York, Merchant. Improvements in doubling or twisting silk, cotton, worsted, linen, or woollen yarns, or yarns from any other fibrous substance.

1449. T. E. Tallent, of Southwark-bridge-road, Engineer. Improvements in the manufacture of leather, and in machinery for that purpose.

1452. H. F. Smith, of Manchester, Agent. Improvements in the manufacture of driving straps or bands.

1454. A. V. Newton, of Chancery-lane. Improvements in casting cylinders and tubes. A communication from F. Adams.

1455. J. Harmer, of Brighton, Gentleman, and W. Parsons, of the same place. Improvements in fire-arms.

1456. T. Cattell, of Euston-sq., Doctor of Medicine. Improvements in the manufacture of varnish and lacker.

Dated June 17, 1859.

1457. T. Orrell, jun., of Bolton-le-Moors, Cotton Spinner. Certain improvements in mules for spinning.

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1458. H. Evette, of Lisieux, France, Manufacturer. A new system of bedding.

1459. E. T. Hughes, of Chancery-lane. Improvements in treating and decomposing fatty substances. A communication from C. Leroy and J. J. M. Durand.

1460. W. H. Hammersley, of Leek, Silk Dyer. Improvements in stringcing, glossing, or finishing silk, and apparatus employed therein. A communication from J. Leigh.

1461. D. Deas, of Carneil, Fife, Farmer. Improvements in reaping machines.

1462. R. A. Brooman, of 166 Fleet-st., London, Patent Agent. Improvements in generating anhydrous steam, and in apparatuses employed therein and connected therewith. A communication from C. M. C. Duplay.

1463. C. F. Vasserot, of Essex-st., Strand. Improvements in the construction of stereoscopes. A communication from H. A. Corbin.

1464. J. J. L. Guiblet, of Wilmington-sq. Improvements in watches.

1465. A. V. Newton, of Chancery-lane. Improved means for assorting substances of different specific gravities. A communication from D. Marchal.

1466. J. Combe, of Leeds, Engineer, and R. Smalpage, of the same place, Woollen Draper. Improvements in winding and spinning machinery, and in arranging and securing a uniform delivery from cops, to be used as weft or warp or for other purposes.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

1444. L. Barroux, of Paris. A new system of rail-road, supported on iron soles, with or without wood being used. Dated June 16, 1859.

1451. M. A. F. Mennons, of Paris. An improved kiln for brick and plaster burning. A communication from A. Mombrun. Dated June 16, 1859.

1453. E. A. Cutler, of Connecticut. A new and useful machine for making horse-shoes. A communication from C. H. Perkins. Dated June 16, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, June* 28, 1859.)

154. J. Fawcett. Food for cattle.
420. W. Raymond. Life-raft.
421. J. Paterson. Brace buckles, loops, and braces.
428. C. E. Wright. Nursing infants.
441. S. T. Cooper. Artificial light.
447. F. W. Emerson. Treating ores of lead.
449. J. H. Johnson. Propelling and steering. A communication.
465. C. F. Vasserot. Carding machines. A communication.
467. F. P. J. Van den Ouwelant. Fire-places.
471. T. Wilson. Ordnance.
474. P. Spence. Alum.
475. R. Jobson. Lubricating bearings.
484. J. Hine. Book-slide.
486. R. A. Brooman. Fixing tannin; dyeing. A communication.
490. S. Ridge. Joints of pipes.
500. R. Mushet. Metallic compound.
501. R. Mushet. Cast steel.
504. A. Lançon, jnn. Watches.
512. C. W. Siemens. Telegraphs. Partly a communication.
513. W. McNaught. Steam-engines.
520. J. Lee. Ploughs.
523. E. Gatwood. Springs.
525. A. Martin. Weaving.
536. E. J. Hughes. Preserving food. A communication.
539. H. Moule. Evaporating, &c.
553. J. W. Harker and J. K. Field. Coating vessels. A communication.
604. C. Mills. Pianofortes.
618. W. E. Newton. Billiard tables. A communication.
693. C. Lambert. Seed drills.
704. W. and S. Pickstone. Textile fabrics.
768. M. A. Muir. Moulding metals.
1098. J. Childs. Night-light cases.
1143. W. S. Booth. Washing machine.
1156. W. Jeffery. Tent camera.
1189. D. Foxwell. Sewing machines.
1258. T. S. Cressey. Cutting staves.
1288. D. S. Price. Dyeing and printing.
1291. A. Prince. Ships. A communication.
1292. A. Prince. Propellers. A communication.
1302. J. Young. Locks, &c.
1333. I. and R. Blackburn. Traction engines.
1374. R. Chrimes. Urinals, wash-hand basins, &c.
1375. E. Gill. Producing spirit.
1336. J. B. Howell, J. Hick, and W. Hargreaves. Applying heat, combustion of smoke.
1400. A. V. Newton. Gas meters. A communication.
1413. M. H. Picciotto. Motive power.
1415. J. James. Motive power.
1431. W. Brown, jun. Carding fibrous materials.
1451. M. A. F. Mennons. Kiln. A communication.
1453. E. A. Cutler. Horse shoes. A communication.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed June 24, 1859.

2939. J. T. P. Newbon, T. Smith, and J. Brown.
2945. D. Edleston.
2952. W. B. Johnson.
2955. T. Steven and T. Scott.
2959. J. Macpherson.
2960. J. Davies.
2962. F. W. Turner.
2965. B. Browne.
2971. J. H. Johnson.
2999. J. H. Johnson.
3000. H. Robin.
1. J. T. Pitman.
7. J. Oliver.
23. J. B. Morgan.
24. J. Luis.
70. W. E. Newton.
77. J. White.
91. W. and W. T. G. Bray.
108. H. Critchley and S. Elston.
129. W. H. E. McKnight.
139. P. A. S. S. Sicard.
142. E. Brooks.
167. J. H. Johnson.
201. D. Moseley.
367. J. H. Johnson.
518. F. Weeks.
715. G. Gregg.
757. J. H. Johnson.
1003. J. Alison.
1016. J. Armstrong.
1074. A. Boyle.

Sealed June 28, 1859.

2976. R. D. Kay.
2989. R. A. Brooman.
2990. R. A. Brooman.
2991. R. A. Brooman.
2992. R. A. Brooman.
2994. W. Burgess.
2996. J. Knowelden and R. D. Edwards.
3005. F. W. A. Casper and G. H. Schmahl.
3006. L. A. Normandy, jun.
4. B. J. Gosteau.
5. J. E. Dronot.
9. J. Garforth.
14. M. Wigzell.
22. A. L. Lévêque.
81. J. Biers, jun.
98. W. and W. McNaught.
145. R. Mushet.
175. T. Greenwood and J. Batley.
178. T. Greenwood, J. Batley, and J. Dockray.
182. H. Sagar and A. Schultz.
183. T. Richardson.
193. J. Childs.
223. J. H. Johnson.
262. H. Watson.
269. H. Grissell.
295. W. E. Newton.
509. A. Reid and R. Tonge.
845. D. B. White.
951. H. A. Silver.
996. H. Rawson.
1073. W. A. Tompson.
1119. W. E. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1468. G. Gurney.
1471. G. Riley.
1477. E. Hardon and J. Henry.
1495. R. W. Chandler and T. Oliver.
1501. G. Durrich.
1513. A. Shanks.
1526. C. A. Messager-Abit.
1529. T. F. Henley.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending June 24, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
2581	1 3	2606	0 11	2617	0 3	2629	0 5	2640	0 10	2651	0 10
2591	0 6	2607	0 3	2618	0 3	2630	2 7	2641	1 4	2652	0 6
2592	1 4	2608	0 7	2619	0 10	2631	0 3	2642	0 3	2653	0 9
2594	1 4	2609	0 6	2620	0 6	2632	0 7	2643	0 10	2654	0 3
2597	0 5	2610	0 3	2621	0 6	2633	0 7	2644	0 3	2655	0 5
2599	0 10	2611	0 3	2622	0 4	2634	0 3	2645	0 3	2656	0 9
2600	0 5	2612	0 3	2623	0 3	2635	0 6	2646	0 6	2657	0 3
2601	0 6	2613	0 8	2624	0 3	2636	0 7	2647	0 3	2658	0 3
2602	0 3	2614	0 3	2626	0 5	2637	0 10	2648	1 6	2659	0 3
2603	0 9	2615	0 3	2627	0 3	2638	0 5	2649	0 4	2660	0 10
2604	0 4	2616	0 3	2628	0 7	2639	0 3	2650	0 6	2773	0 7
2605	1 6										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

BRITISH IRON, *East India Company.*—Particulars at the Secretariat office, where the proposals are to be left before 11 forenoon, July 5.

GAS PIPES, *Bilston Gas Company.*—Cast iron, spigott, and socket pipes, as follows:—2,250 yards 8-in. pipes, weight per yard, 126 lbs., 750 pipes.; 780 yards 5-in. pipes, weight per yard, 70 lbs., 260 pipes. Of an equal thickness throughout and sound, under 250 lbs. to the inch. Further information Mr. John Mudie, Resident Engineer, the Works, Moxley, Wednesbury. Tenders stating price per ton, July 14.

CAISSON, *Leith.*—For the entrance to the graving dock. Drawings, &c., Mr. Robertson, Resident Engineer, Dock Works, Leith. Tenders to John Phin, Clerk to the Commission, 13 Herod's Row, Edinburgh, July 16.

SEWERS, *Mile End Old Town.*—For the construction of sewers in certain streets in the east ward of the hamlet. Drawings with the Surveyor at the Town House. Tenders, with names of two sureties of £300, before 3 o'clock July 6, to Thos. Price, Clerk to the Vestry.

SEWERAGE WORKS, *Warrington.*—Contracts, 8 and 9. Drawings, &c., Mr. B. P. Coxon, borough engineer. Separate tenders, July 13, to chairman of Paving and Sewerage Committee.

BARRACK WORKS, *Chatham.*—1. Stripping, repairing, and slating 5 roofs at the carriage store, Gun-wharf, Chatham. 2. Erecting tower and water tank at Brompton Barracks, Chatham. Information, Royal Engineers' office, Chatham Lines, Kent. Tenders, July 9.

WORKHOUSE, *Machynlleth.*—Whole or portion of new workhouse. Drawings, &c., board-room. Bills, Mr. J. E. Oates, architect, York. Tenders, July 6.

CITADEL, *Dover.*—Extensive excavations in and raising the parapets of the citadel. Information Royal Engineer's Office, Dover, July 5. No date given.

GASHOLDER, *Gateshead.*—100 ft. diameter, 20 ft. deep. Specifications Mr. J. Bourne, engineer, of North Eastern Railway, Central Station, Newcastle-upon-Tyne. July 6.

ROADS, *Norwood.*—For the excavations, earthwork, drains, and culvert required in the formation and metalling of roads to be formed on the White Horse estate, Norwood. Drawings, &c., Messrs. Burrell, Surveyors, 14 Lincoln's Inn Fields. July 5.

CEMETERY, *Walcot, Salop.*—For chapels, lodge, entrance gates and boundary walls. Drawings, &c., Messrs. Dickes and Isaacs, 13 Northgate-street, Bath. Tenders July 11.

WORKHOUSE, *East Grinstead, Sussex.*—Drawings, &c., Mr. S. F. Cox, 22 Henrietta-street, Covent Garden; of whom and of Mr. W. Lass, further particulars. Tenders 1 o'clock July 7.

PARSONAGE HOUSE, *Nantygw, Newport, Monmouthshire.*—Plans, &c., Rev. J. Morgan, Nantygw. Estimates to Mr. Norton, 24 Old Bond-street, London, July 9.

FARM HOUSE, &c., *Horsham-park Estate, Sussex.*—Plans, &c., Kingshead, Horsham. Tenders, July 5.

HOUSES, *Bishop Canning's Estate, Wiltshire.*—Erection of cottages, farm premises, and alterations and repairs at farms. Plans, Crown Inn, Bishop's Canning's. July 4.

FARM HOUSE, &c., *Earnshill Estate, Somerset.*—Plans, &c., Mr. Hilliers, Donyatt, near Ilmington. July 9.

STONE, *Leamington.*—1,000 tons of the best hand-picked Hartshill, and 15 tons of Hartshill rough grouse for macadamizing, at the Tachbrook-road wharf, Leamington, in quantities, during the next three months. Tenders, the Surveyor, Town Hall, July 4.

DESIGNS FOR CEMETERY, *Great Malvern.*—Lithographed plan of the ground, and rules, of the Churchwardens. No date given.

FLINTS AND BROKEN GRANITE, *Bethnal Green.*—2,000 yards of picked Kent flints, broken to a two-inch guage, at the vestry's wharf, Old Ford-road, pursuant to specifications of the surveyor, Town Hall. Tenders with a £10 note at the office of the vestry clerk, Town Hall, Bethnal Green, July 6. Also 2,000 yards of broken granite. Conditions and time for tenders same as for flints.

COAL, *Pancras Workhouse.*—500 tons of Lambton or Stewart's Wallsend, and 300 tons of good strong furnace. Tenders, 2 o'clock, July 12.

COAL, *Tunbridge Wells Gas Company.*—2,000 tons of Harvey Main gas, at per ton, in periodical deliveries. Tenders, 6 p.m., July 13.

COKE, *London, Brighton, and South Coast.*—For the supply of 3,000 tons of the best locomotive, to be delivered at their option alongside Deptford, Newhaven, or Kingston wharfs, near Shoreham. Delivery to commence at once, in portions of not less than 300 nor more than 500 tons per month. A separate price to be quoted at each place. Quantities approved one month to be paid for in the next. Further particulars, Mr. J. C. Craven, Brighton terminus. Tenders by 10 A.M., July 7.

WORKING OF COKE OVENS, *London, Brighton, and South Coast Railway.*—The contractor to supply the coal and to keep the ovens in repair. The produce to be 212 tons per week. Ovens, New Cross. Term, 12 months, commencing August 1. At per ton, delivered into the waggons at the siding adjoining the ovens: to which siding the coal will be conveyed, free of charge to the contractor, from the Company's wharf at Deptford. Particulars, Mr. J. C. Craven, Brighton Terminus. Tenders, by 10 A.M., July 7.

SURVEYOR, &c., *Aldershott.*—To act as inspector of nuisances, and collector of rates also, for the parish of Aldershott. Salary, £50 per annum. Candidates to attend at the meeting of the Board of Health, Aldershott, at eleven, July 5.

PRICES CURRENT OF METALS,

London, 1st July, 1859.

		£ s. d.		£ s. d.	Dis. p. ct.
IRON, Rails in Wales and N. of England	pr. ton	6 0 0	to	6 5 0	nett
Welsh Bars, in Wales	„	5 15 0		6 0 0	3
Staf. Bars at the Works	„	7 0 0	„	7 10 0	2½
„ Hoops	„	8 0 0	„	8 10 0	„
„ Sheets, Singles	„	8 10 0	„	9 0 0	„
„ Nail Rods	„	7 0 0	„	7 10 0	„
„ Boiler Plates	„	8 10 0	„	9 0 0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2 7 9		2 8 0	nett
Do. No. 1, Good Brands	„	2 9 6	„	2 10 0	„
Scotch Bars	„	7 0 0	„	7 10 0	2
Swedish Bars, in London	„	13 10 0	„	14 0 0	2½
COPPER, Sheet and Sheathing per lb.		0 1 0			3
Tough Cake and Tile	„ ton	107 10 0			„
Best Selected	„	110 10 0			„
Australian	„	106 10 0			„
South American					„
Yellow Metal Sheathing	per lb.	0 0 10			„
STEEL, Swedish Keg	pr. ton	19 10 0	„	20 0 0	2½
„ Faggot	„	21 10 0	„	22 0 0	„
TIN, English, Block	pr. cwt.	6 9 0			3½
„ Bar	„	6 10 0			„
Foreign, Banca	„	6 14 0			nett
„ Straits	„	6 10 0		6 11 0	„
TINPLATES, Charcoal, I.C.	pr. box	1 11 0	„	1 12 0	3
Coke, I.C.	„	1 5 0	„	1 6 0	„
LEAD, Pig, English	pr. ton	22 15 0	„	23 5 0	2½
„ Spanish	„	22 0 0	„	22 10 0	„
Sheet	„	24 0 0		24 10 0	„
SPELTER, on the spot	pr. ton	19 0 0		19 5 0	nett
for arrival	„				„
ZINC, English, Sheet	„	25 0 0	„	27 0 0	„
QUICKSILVER	per bt.	7 0 0			1½

REMARKS.—Prices of Metals are in general firm, but business continues on a limited scale.

LAWRIE AND HAGGER, Metal Brokers.
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 8, 1859.

THE IRON STEAM FRIGATES OR RAMS.

THE writer of an article which appeared in the *Times* of Thursday, the 30th ult., and was quoted in our last number, criticised the Admiralty with some severity, and not without sarcasm. The grounds of his complaints were, first, that a foolish attempt to conceal the character of the new iron ship in the presence of an enemy was contemplated; and, secondly, that while the great purpose with which the ship has been designed is that of "ramming" down an enemy, no provision has been made for clearing her of her masts and rigging—which must, the writer assumes, "come down by the run," when the ship is driven against the enemy.

Now, offensive as it may be to show that the premises from which such weighty conclusions are drawn are false, we have to state that the writer in question is wrong in both his assumptions. No absurd attempt to conceal the character of the new ship from the enemy is contemplated. The only fact brought by the writer in support of his view—or rather, the only fact upon which his conclusion in this matter is based—is that the new ship, like every other large English ship of war, is to be furnished with a knee of the head. It may be true that this feature of the vessel will in her case be of less service than it ordinarily is, since the bowsprit and bowsprit rigging may possibly be fitted independently of it. But without such a feature the vessel would be needlessly ugly; and it is doubtless for this reason, if not for any other, that the knee is to be fitted. We do not—we cannot — for a single moment believe that the Admiralty authorities have connected any fatuous expectations of concealment from the enemy with their arrangements in this respect. It is evident that if the knee of the head were omitted from this particular ship that feature would be so "conspicuous by its absence" that her character would be declared at a glance to the dullest enemy, if he had but eyes in his head. This the Admiralty know, of course, perfectly well, and are too prudent to give so conspicuous a sign to the foe. As they intend to build her, she may be so fortunate as to escape the observation of some careless observer at the right time, and this chance is accordingly given her. To say that the Admiralty anticipate more than this is to libel their intelligence.

In his second position the writer is equally at fault. The ship in question has been designed, not as a ram primarily, but as a shell-proof frigate. Her armament, and not her bow, is to be her means of offence. The Admiralty have very judiciously decided on so forming and strengthening her bow that if, upon an emergency, the resort to such a clumsy and questionable expedient as that of attacking a ship by running full butt against her should be deemed advisable, the operation may be effected with as little damage as possible to the new iron ship. And as Admiral Sartorious and Mr. Nasmyth have taken so much trouble to recommend this expedient to ourselves, the French, and others, no one can blame the Admiralty for the step they have taken in this respect. But it is altogether a mistake to suppose that the ram-bow is any more than a subordinate feature of the ship.

The *Times'* writer deems it "unwise to cumber her with the masts and rigging of a line-of-battle ship." We entirely dissent from him. Were she not so rigged it would be impossible to send her with safety in the presence of an enemy. Lighter masts and rigging would never afford her the necessary means of sailing and manœuvring in the event of her screw, her engines, or her fuel failing, and we know too little of the effects of a naval battle with steamships to leave such a ship dependent upon her steam alone. No action between steam-ships has yet been fought, and it is very doubtful if such an action would not reveal the impotence of either the screw or the engines in close conflict. Especially is this true now that rifled guns, and other weapons of precision, are finding their way into ships of war.

Nor can we leave this point without mentioning that the writer under notice has unwittingly dealt a heavy blow to the scheme of Admiral Sartorious. The question which the former has sarcastically put to the Admiralty really addresses itself to that gallant officer. How does *he* propose to clear his "ram" of her own wreck of masts and spars? This is for him to answer, because the running down of ships *is* the primary object of his vessel.

There are many minor inaccuracies in the article under notice, some of which it may be worth while to mention. The writer says:—

"Neither the bows nor stern have any of the large armour plates, *but are coated with wrought iron plates of nearly one inch and a half thick over two feet of teak*, which will offer sufficient resistance to prevent most shots from going through. But to compensate for this apparent deficiency *both bows and stern are so crossed and recrossed in every direction with water-tight compartments* that it is a matter of perfect indifference whether they get riddled or not, and each of these ends are shut off from the engine-room and fighting portion of the ship by continuous massive wrought iron transverse bulkheads. So that, supposing it possible that both stem and stern could be shot away, the centre of the vessel would remain complete and impenetrable as ever, *still offering in all 24 inches of teak coated with 5 inches of wrought iron to every shot.* But both stem and stern are built inside of such immense strength that coating with armour plates would be almost superfluous. The bows, as the spot where the whole shock must be received in running down ships, are inside a perfect web of ironwork, *strengthened back to the armour plates with no less than eight wrought iron decks an inch thick, and crossed and recrossed in all ways and methods with diagonal bracings and supports.*"

All the passages marked in italics are entirely wrong. Neither the bow nor the stern is either coated with 1½ inch iron or lined with teak. They are, so far as the plans at present adopted provide, formed of iron similar to that used in ordinary stout iron ships. Nor are the bows and stern to be crossed and recrossed with water-tight compartments "in every direction." They have several flats of thin iron at different heights, corresponding to ordinary decks; but the only water-tight bulkheads are a few transverse ones of common iron. This is, of course, exclusive of the transverse shell-proof bulkheads at either end of the defended portion of the vessel. These are formed of 4½ in. (not 5 in.) iron backed with wood. The "diagonal bracings "and supports," spoken of by the writer, form no part of the Admiralty design, so far as that is yet completed. The same remark applies to the "telescopic bowsprit," mentioned elsewhere by him.

It is much to be regretted that the false impressions which such an article as that referred to must necessarily produce should have gone forth to the ends of the world with the sanction and authority of the *Times*. While so much room is afforded by the Admiralty for just and useful criticism, it is sad to see the power and influence of such a journal frittered away in such a manner.

THE DECIMAL SYSTEM.

THE question of a Decimal Scale, as regards weights and measures, is not by any means a novelty. In the year 1816 a Royal Commission was appointed "to consider how far it might be practicable or advisable to establish a more uniform system of weights and measures." The Commissioners were Sir Joseph Banks, Sir George Clerk, Mr. Davies Gilbert, Dr. Wollaston, Dr. Thomas Young, and Captain Kater. Three years subsequently, these gentlemen made their unanimous report, and it was adverse to alteration. In 1824 Sir John Wrottesley brought before the House of Commons a motion for inquiring into the applicability of the decimal scale to coins. He referred to the example of France, of America, and China, and urged the simplicity of their system of accounts as compared with the complex arrangements in use at home. Sir John's scheme was to employ pounds, double shillings, and farthings, the last having four per cent deducted from their present value, and thus making 100 farthings = 1 double shilling, 1,000 farthings = 10 double shillings = 1 pound. At that time of day it was customary for Masters of the Mint to have seats in the House of Commons, and Mr. Wallace, who then filled the office, opposed Sir John Wrottesley's plan, whilst admitting its advantages. The motion was unfortunately therefore withdrawn—the only good which came of it being that the Government agreed to assimilate the currencies of Great Britain and Ireland; a promise faithfully kept shortly after. Matters rested thus till 1834, when the Houses of Parliament were burnt, and the standards of weights and measures were destroyed in the fire. Much discussion followed this catastrophe—the destruction of the standards, we mean—and the question of their restoration was referred to a Commission in 1838. In 1841—three years appear to be the usual period for hatching a report—in 1841 this Commission, which included three astronomers, made their report; and it contained among other matters the following statement: "The first point which has called for our special notice is the general question of the decimal scale. In introducing this subject we invite the attention of Government to the advantage and the facility of establishing in this country a decimal system of coinage. In our opinion no single change which it is in the power of a Government to effect in our monetary system would be felt by all classes as equally beneficial with this." The worthy Commissioners then proceed to recommend substantially the plan of Sir John Wrottesley previously mentioned. The consequence of this recommendation was, that in 1843 *another* Commission was appointed with a view to a further consideration of the matter. The report of this Commission, which included Lord Wrottesley—formerly Sir John—proposed to carry out the suggestion of the standard Commission of 1841.

On the 27th April, 1847, Sir John Bowring moved for an address to the Crown in favour of the coinage of silver pieces of the value of 1/8th and 1/16th of the pound sterling. Sir Charles Wood, the Chancellor of the Exchequer of that day, objected to the latter coin but had no objection to the former—hence, Sir John Bowring, preferring a half measure to no measure at all, withdrew his motion—and the florin was ordained. A considerable period elapsed before the new coin made its appearance, and when it did so, it was amid great uproar. The engraver of the Mint, W. Wyon, Esq.—since deceased—had engraved several model dies for the new coin, and these, or rather pieces struck from them, had to be submitted to Her Majesty and Prince Albert for approval.

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It did so happen that these illustrious personages fixed upon that peculiar design in which the artist had been compelled, from the small diameter of the die, to omit from the legend on the obverse the words DEI GRATIA, and even the initials D. G. Now arose the uproar, the Master of the Mint, poor Mr. Sheil, who had been appointed for the express purpose of ejecting from their posts the Company of Moneyers, and who was innocent of everything pertaining to coining — poor Mr. Sheil was a Roman Catholic, and several zealous Protestants, therefore, began to cry out—Conspiracy! Conspiracy! For had not the clever little lawyer eliminated that part of the inscription from the new coin which makes Her Majesty reign "by the Grace of God!" The hue and cry raised against Mr. Sheil and his "Godless" Florin—a wonder it was not named the "Devil's ducat"—added to the real disadvantage of the coin being too dumpy to be musical when thrown on a counter, led to the withdrawal, or rather to the discontinuance of the coining of the experimental piece; and Mr. Wyon engraved the dies for the existing florin, in which the theological difficulty and that of the shopkeeper are swept away. So much for the introduction of the first decimal coin. A very large issue of these 10ths of the pound had gone on up to 1853, when Mr. W. Brown, M.P. for South Lancashire, moved for a Select Committee —*Commissions* had, it seemed, done their best and worst—to take into consideration and report (once more) on the advantages or otherwise which would arise from adopting a decimal system of coinage. The Committee was appointed — all the witnesses examined by it, twenty-five in number, with the exception of Mr. Headlam, M.P. for Newcastle, were in favour of the introduction of the particular scheme proposed in 1841 and 1843, and known as the Pound and Mil scheme. In August, 1853, three months after its nomination, this comparatively hard-working Committee reported itself. The report stated that the existing system was needlessly complicated, calculated to create confusion as regarded questions of Foreign Exchanges, and otherwise generally inconvenient. By the introduction of the decimal system, on the contrary, the Committee's report went on to assert, an important benefit would be derived in several departments of the public service and in every branch of industry, from the economy of skilled labour which would result from the proposed change; at the same time, that education in our schools, so far as arithmetic was concerned, would be facilitated. The Committee of 1853 further recommended the pound sterling as the unit of the new system of coinage — a recommendation which, at this hour, we think to have been based on a truthful foundation.

This unmistakeable opinion, backed by a quarter of a hundred of scientific witnesses, when it came to be promulgated raised much discussion in pamphlets, newspapers, and magazines, and zealous advocates of the old and new schemes did battle on the occasion.

The year 1853 may be considered an era in the decimal coinage agitation, and early in 1854 a Decimal Association owing its rise principally to that agitation sprang into existence. A deputation from this active and persevering body soon waited upon Mr. Chancellor of the Exchequer Gladstone, and urged the immediate introduction of the Pound and Mil scheme. Mr. Gladstone met the proposition with some remarks which showed his knowledge of the subject, and leads us now to hope that, restored to the same onerous post he then occupied, there is still a chance, despite Lord Overstone, of a decimal coinage. Mr. Gladstone said he could not doubt that a decimal system of coinage would be of immense advantage in monetary transactions. The weight of evidence was entirely irresistible on that point. As to the particular system to be most beneficially introduced, that was another thing. We had not anything like unanimity on that point. The Government could scarcely take the initiative, unless a definite plan calculated *to overcome prejudice* among the masses of the people generally and to meet business complications could be set before them. In such terms and by prescribing patience did Mr. Gladstone meet the deputation of 1854.

There is no doubt that since then the popular mind has been considerably enlightened on the matter, for fortunately the association named have by means of tracts, discussions, and lectures, disseminated much valuable information on the subject. Mr. Cardwell—also again in power—in reply to a deputation in 1854 from the indefatigable body named, said that there was no doubt at all about the value of a decimal system of coinage—all authorities of any weight were unanimous in support of it. Like Mr. Gladstone, however, Mr. Cardwell could only counsel patience. Five years have elapsed since then. Surely patience is now entitled to its reward. On the 12th of June, 1855, Mr. W. Brown moved the following resolutions in the House of Commons: 1. That in the opinion of this House the initiation of the decimal system by the issue of the florin has been eminently successful and satisfactory. 2. That a further extension of the system will be of public advantage. A long debate followed, and on a division the first resolution was carried by 135 to 56. The second resolution was carried without a division, whilst a third which advised a completion of the decimal scale by the issue of silver coins of the value of the 100th part of a pound, and copper pieces of the value of the 1000th of a pound, was withdrawn.

The Government objected during the debate so manfully incited by Mr. Brown, to a change which would, they said, so "deeply affect the "poorer classes." They also promised the "most careful consideration possible to the "subject" in the future. In 1856 a new Royal Commission, consisting of Thomas Spring, Lord Monteagle of Brandon, Samuel Jones Lord Overstone, and John Gellibrand Hubbard, Esq., was nominated for the purpose of inquiring into the "expediency of introducing the principle of "decimal division into the coinage of our "United Kingdom." Of the labours of this latest Commission and its final report we shall probably have something to say next week.

Five and twenty years ago a Master of the Mint alone caused the rejection of Sir John Wrottesley's scheme; now the opinion of a Master of the Mint is not equally weighty with that of Samuel Jones Lord Overstone—as it seems.

THE EDUCATION OF MECHANICAL WORKMEN.

WHO is to determine what mechanical workmen shall be taught? Not the untaught workmen themselves, for the value of knowledge is known only to those who possess it. Not mere schoolmen or professors, for none but he who understands a craft can judge what is fittest for the craftsman. Who, then, shall tell us what that knowledge is by which, and by which alone, the appetite of the intelligent and aspiring mechanic may wisely and healthily be satiated? The question is of immense importance in this land and this age; for our present energies seem directed almost exclusively to the development of mechanical agencies, and the extension of mechanical arts.

To us it appears plain enough that we must look for enlightenment upon this subject to those few men who, while eminent for mechanical skill themselves, have the happiness to combine with it that sound sense and that liberal culture which are indispensable to every man who would guide the minds of others in these times. Perhaps there is no man more thoroughly competent to enlighten and advise us upon it than the gentleman who last month spoke upon this very question to the students and visitors at the South Kensington Museum — Mr. J. Scott Russell. If we had been asked to point to a person from whom the soundest knowledge of the intellectual wants and necessities of mechanical workmen might be elicited, to whom could we have more appropriately turned than to him whose brain and hand have for weeks past been, and at this very hour are, informing, directing, and controlling that huge hive of mechanics who are giving strength, and completeness, and splendour to that wonder of the modern world—the Great Eastern?

Mr. Russell's lecture was undertaken in consequence of a conversation which took place not long ago between Mr. Henry Cole and himself on the subject of the education of the class of workmen to whom he (Mr. Russell), as he said, belonged. Mr. Cole had shown him some papers which he had prepared for the purpose of examining workmen as to the progress which they had made in the kind of education generally provided for them; and remarked that the education provided in this country for workmen was not very directly calculated to render them good workmen. With this Mr. Russell agreed, and as a large employer of skilled labour, he now (in his lecture) asked whether there was any description of education which would tend greatly to the increase of the skill, dexterity, ability, and success of the practical working mechanic. He maintained that there was, but that the mechanic did not get it. He himself was obliged to get his very best draughtsmen and mechanics from foreign countries. He had men in his employment from Prussia, Germany, and Holland; and he was bound to say that, as far as preliminary education was concerned, although the workmen of foreign countries had not the skill obtained by the British workmen from practical experience, their scientific knowledge was greater, and that knowledge was telling so rapidly on the present generation of workmen, that we were now equalled (he would not say excelled) by the workmen of many countries upon whom we were inclined to look down a few years ago.

This is strong and most serious testimony Mr. Russell did not say anything, of course, against the education now given. "On the "contrary, he would say, continue to teach "drawing, reading, writing, and accounting in "the best manner you can; but if you have a "class of young workmen coming forward to "learn, think how you can turn the little time "they can afford to give to the best advantage "so that you may raise them higher in the "social scale and make them better workmen." In order to do this, it would be necessary to give them a higher class of education than they were ever taught before. We did not go far enough; but the pupil teachers whom he addressed were not to blame. The persons to blame were their teachers. Two years was perhaps all the time that could be devoted to education, and six months were often devoted to as may books of Euclid, which were wasted for all practical purposes, unless, indeed, the student intended to become a professor. He would advise them to skip over the beginning, and devote the least possible time to Euclid—in fact, he would advise them do a very heterodox thing —to cut off all the propositions but the useful

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ones. They might naturally exclaim, "Then how little will be left." Very little, he admitted, but plane trigonometry would be left. Suppose, for instance, a man had but six months in which to learn. Six weeks might in that case be given to Euclid, and then trigonometry might be commenced, solid geometry might next follow, and that constituted the whole education of the workman. But that was precisely what he did not get in the present day. He would also teach within the six months conic sections, and afterwards the nature of curves, within the first, second, third, and fourth degrees. He was aware he might be met by the exclamation, "Oh! but we shall be teaching them more than we ourselves understand:" but to this he would answer, "That is the fault of your education." Sir Isaac Newton discovered no less than 130 curves, and nine-tenths of them would be of great use to the mechanic, if he had them in two places—in his head and at his fingers'-ends.

Having now got to teaching something which they did not know, and had not learned, the next thing they wanted was, said Mr. Russell, the assistance of the Government. Decent elementary text-books were wanted for the higher departments in mechanics, but there were many able men versed in the sciences; and what he wanted the Department of science and Art and the Government to do was, to ask the four cleverest men in England to write, in the fewest possible English words, all that they knew (not all that they had read), or, in fact, so much of their brains as they carried about with them. If Government would but pay handsomely for these books, a set of treatises might be collected such as the world never saw *before*, and such as would be sufficient to teach any mechanic his business. They might, it was true, say, "But we do not know where to get these clever men." But he knew where they were to be got. There were three of the four present at that moment; and if the Government would but give them a thousand pounds a-piece for writing the books, he was sure they would write them. What he had said about geometry was true as to mathematics. Of great importance to the working man was the comprehension of the laws and relations of numbers, so as to enable the working man to think in figures about the immediate business before him. Having explained the manner in which mechanics might make reduced or enlarged models, and the relations and practical properties of numbers, the lecturer illustrated the value of a knowledge on these points by an anecdote. "He remembered an instance in "which a respectable working man sent in a "tender for £12,500 for a very large piece of "work. The tender appeared to be low, and he "obtained the order, and got on some way with "his work when he found he had made a trifling "omission—he had forgot to multiply by *two*. "His figures were all right, but in one place he "forgot his multiplication, and his whole cal-"culations were wrong." He was of opinion that geometry ought to be taught by a large and comprehensive system.

Mr. Russell continued to say that, with respect to solid geometry, the two great duties in a workman's life were conversion of materials and adaptation to strength. A mason who used up a wrong stone, or a carpenter who selected a wrong plank or piece of timber, showed that he was ignorant of one of the most useful portions of his art or calling. Now, nothing would teach conversion of materials like solid geometry; it was in fact the daily business of the workman. It had been said that every block of marble cut from the quarry contained a beautiful statue, but the art was how to get it out of it. This was very true; for what workmen wanted to know was every shape, and how to get out another shape. The workman who took from a heap a block of stone, or piece of timber that cost his master 50s., when a piece could be got, answering quite as well, which cost 25s., inflicted a loss upon his employer perhaps equal to a week's wages. Hence the necessity of acquiring a knowledge of solid geometry. But if there were beauty in the quantity of numbers, and in regular geometrical figures, there was infinitely more beauty in curves. It was the duty of many mechanics, especially of those engaged in ship-building, to make curved lines. To him it had always been an interesting subject to learn how curves grew. He was aware that he might be told that the higher curves were never taught, but his answer was that they might easily be taught, and that they were very easy of comprehension. In order to effect this, somebody who understood the subject would have to be prevailed upon, not to write a book, but to put down in the shortest and plainest possible language what he knew of curves. This would be a treatise which the workmen could understand, and would be well worth the thousand pounds which he hoped the Government would be prevailed upon to give to one of the four clever men to write.

The remarks which we have above briefly sketched,* need no comment. It only remains for us to add the finishing words of the lecturer. The subject of the education of the workman was one which he had, he said, very much at heart. He did not know how it was to be given, but as the pupil teachers were present as an institution which took charge of the mechanic, and a Government which was anxious for the spread of education, he would urgently beg of them to take counsel with half-a-dozen of the best mathematicians of the day, and arrange with them to write short treatises, which could be circulated at a cheap rate, and which could be taught in our elementary schools. He also thought that there ought to be a large quantity of apparatus—a sort of inventory of education—of every conceivable shape and object. In addition to these models, he would have the schoolroom hung round, not with pictures of animals, but with solid bodies, which could be explained and drawn. He would, in fact, impart any kind of practical rather that book knowledge. If drawings merely were used instead of models, he did not think the student could imbibe so correct a notion of the object to be produced or delineated. There was a mode of studying forms called *la théorie de développement*, but the plain English meant nothing more than making flat surfaces into round and angular forms (as models now made from sheets of paper, which was a most valuable mode of studying forms). If this description of education could be given, he would take the pupils educated in that department and give them three guineas a week. He might afterwards raise them to foremen with salaries of £500 a year, and that would be far better than remaining all their lives at the bench, earning 30s. a week. Machinery could now be obtained to do all the unintellectual drudgery of mechanism. He was not opposed to machinery, and had no apprehension that it would supersede skilled intellectual handicraft. He would employ machinery to do all the drudgery that degraded the workman into a beast of burden. He would give him higher views of mathematics; he would show him that he was an intellectual, thinking being, with a soul for high and immortal things.

* From the only published report which we have seen, and which appeared first in the *Builder*, we believe.

A LORD ON LABOUR.

LORD NAPIER, our late representative in the United States, has, in his recent speech at the Society of Arts' dinner, addressed us on a topic of which it is cheering for us to be occasionally reminded. It cannot be too often repeated, said he, that more than half the population of the British empire live by arts, manufactures, and commerce—that is, they subsist on the results of skilled labour, or labour directed by speculation, invention, and design, in contradistinction to the simpler forms of industry. A vast proportion of the manufactured productions of the British people are exported to foreign countries, where they have to compete with the domestic manufactures of those countries, often guarded by protective tariffs, or with the productions of other states stimulated by commercial rivalry and administrative encouragement. Nor are the resources of the home market to be enjoyed in security or negligence; for though we possess in the unrivalled mineral structure of our soil a broad basis of natural advantages, and though we derive from the thrift and contrivance of our ancestors a noble heritage of accumulated capital and knowledge, yet we can only maintain our superiority by ceaseless vigilance and exertion, and we may not expect any artificial defence by a recurrence to the prohibitive system.

Starting with these considerations, he reminds us that the industrial movement of England at home and abroad is therefore one of anxiety and strife, and it is our bounden duty to levy from every department of intellectual inquiry auxiliaries in maintaining and enlarging our present ascendancy. "If we be true to the "examples of the past and watchful of the pre-"sent emergencies I would not speak with ap-"prehension of our commercial future. Far "from thinking that the universal demand has "attained its full proportions, or that British "industry has necessarily reached its culminating "point, I conceive that the powers of consump-"tion in the world never appeared so capable of "indefinite expansion, and that the incalculable "activity of another age may revert with "curiosity, and perhaps with indulgence, to the "respectable efforts of the nineteenth century. "Passing over the home demand, which is sus-"ceptible of a steady development proportioned "to the increasing numbers and wealth of the "nation, there is much of an encouraging na-"ture in the prospects of the foreign market, "whether we regard those half-civilised nations "which take off the commodities of common "utility, or those communities at a higher "stage of culture which afford a market for ar-"ticles of luxury and beauty."

The ancient and stagnant empires of the East, recently disturbed by our diplomacy and arms, swarm, he tells us, with a population equal to the united numbers of Europe and America. Surely we are justified in expecting that the vehicles of our exchanges with those regions will not long continue to be silver and opium, the former of which owes no portion of its value to the manipulation of the British artizan, while the latter is the creature of monopoly and the cause of demoralisation. It is not extravagant to anticipate that when the barriers of traditional prejudice and fiscal exaction are dissolved, the multitudes of China and Japan will gradually unfold an immense market for the ordinary fabrics of Europe. Turkey, Persia, and Central Asia, without any important staple of exportation, and inhabited by a sparse, indigent, and in part vagrant population, approximately estimated at forty millions, annually absorb more than seven millions worth of British manufactures. At the same rate the inhabitants of the remoter East, who must eventually ex-

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hibit greater faculties of consumption and exchange, would draw annually sixty millions' worth of goods from Great Britain—an amount equal to more than one half of the produce of the United Kingdom exported abroad. If Brazil be selected as the standard of comparison, a far higher result would be obtained. Add, then, to those portions of Asia but half appreciated and explored the nations of India, Africa, and the Pacific Archipelagos—all of which are, by conquest, commerce, or conversion, being subjugated to European ideas and manners—and the boundaries of our uncivilised market appear to recede into an impenetrable distance.

The aspirations of the British people are not limited, however, as the eloquent speaker reminds us, by the grosser conceptions of cheapness and quantity. It must not be alleged that the gracious genius of English industry merely drudges in the service of a barbarous demand. It is our aim to invest the most familiar and useful objects of manufacture with some appropriate charm, and to rival the accredited seats of cultivated labour in the production of articles of a purely decorative and æsthetic character. If the markets of continental Europe be partly closed against us by the existence of older establishments, or by the force of conventional fashion, or by the obstinate impediments of illiberal legislation, we may still find in the new markets of rising states, in those which have been planted by the adventure of our own race on the plains of America and Australia, a fair field and ample scope for the higher departments of invention and design. The discovery of gold has been the chief instrument in the formation of the markets here alluded to, and it will long continue to be the basis of their prosperity. The importance of that discovery is not to be sought so much in the amount added to the circulating medium, or in a general rise of prices, which is precarious, and in part delusive: it is to be found in the sudden dispersion over vacant countries of men furnished with all the faculties, and feeling all the necessities of civilization, engaged in a description of labour requiring neither capital nor combination, nor considerable consumption of time, but resulting in the delivery of a commodity which, if it does not directly add to the mass of productive capital, is at least always in the highest demand, and subject to the smallest fluctuations of value. In no other inconceivable form could twenty millions' worth of exchangeable produce have been annually raised with such celerity, and no motive save the intoxicating cupidity belonging to the pursuit of the precious metals could have impelled mankind to such immense migrations.

Nor is the consequence of this great movement of the English race—(we still follow the thought and repeat the language of Lord Napier)—to be measured by the mere value of the precious metals now or hereafter collected, for while one portion of the population set on foot by that primary incentive sift the auriferous soil with increased assiduity, or apply more scientific processes to the reduction of the rock, or carry their insatiable inquisition and predestined power over those desolate empires, escaping from the paralysed grasp of the Spanish colonists, another portion are ever betaking themselves to various kinds of accessory labour, and to the creation of other articles of traffic which, though not in such instant demand, will, in the long run, become a profitable addition to general commerce.

It would not be difficult to show that the wants of other nations and the dissemination of our own are sufficient, if wisely used, to provide abundant employment hereafter for the industrial energies of England. "I also humbly "think that, whether we regard the govern- "ment of the country, or the forces sponta- "neously operating in the ancient and complex "frame of our society, there are many causes "uniting to afford an intellectual and artistic "education to the working orders commensurate "to the task which lies before them." First, with respect to the action of government and parliament there is now, perhaps, in principle, as much direct intervention as is consistent with the spirit of our free institutions. In the British Museum, at Hampton Court, in the National Gallery, at the Kensington Museum, and in other repositories of national possessions, the historical examples of arts and manufactures are rapidly accumulating, which we hope to see placed in magnificent and instructive combination, and which will then only obtain their full value for imitative and suggestive purposes. In 78 schools of design, cheap instruction is afforded to 79,000 pupils, whereby the poorer classes have the opportunity of discovering and improving gifts of native genius, and although our public edifices and monuments recently constructed cannot be regarded with unqualified approval, we may at least hope that the Government has a poignant sense of past errors; and it has certainly shown a desire by pecuniary rewards and competitive exhibitions to draw the highest talent to the service of the state. Allied with the Government of England, or sanctioned by our laws, we find many institutions of a corporate character, which though not designed for the encouragement of arts, must yet, in an intelligent and critical age, by their opulence and associations, become powerful vehicles in fostering the principle of good taste.

But it is certain that neither governments, nor corporations, nor societies, can be profitable agents without a generous, responsive, and critical public. History shows how academies may go on teaching and prating amidst general sterility. There will not be intelligent producers without intelligent purchasers. But the industry of England is nourished from a thousand silent and spontaneous sources. "Our "treasures are not only laid up in museums, "like grain in warehouses; they are also scat- "tered in our homes, like good seed in pleasant "and fruitful places. Many do not worship in "the public temple who have built domestic "altars to the arts. Consult those quiet habi- "tations of the beautiful and good, how many "modest deeds and gentle voices attest the "prevalence of a beneficent culture."

We offer no apology for re-echoing the noble language of this noble lord. We have our own strong persuasions respecting the swiftness and certainty of our national progress; but although we need no assurances like the above for our comfort, we observe with pleasure that so just an appreciation of the present, and so enlightened an expectation of the future, has already reached the minds of those who have heretofore been slow to learn like lessons.

SOCIETY OF ARTS.

AWARD OF MEDALS AND PRIZES.

THE Council of the Society of Arts, on the recommendation of their Committees, have awarded the following Medals:—

To Messrs. Hamilton and Nash, for an "Improved Lock." *The Society's Silver Medal.*

To Messrs. Peter and Charles Garnett, for their "Toothed-Roller Cotton Gin." *The Society's Silver Medal.*

To Mr. F. Jaubert for his invention of "A Method of rendering Engraved Copper Plates capable of producing a greatly increased Number of Impressions," and for his paper explanatory of it, read before the Society. *The Society's Silver Medal.*

To Mr. E. J. Reed, for his paper read before the Society—"On the Modification which the Ships of the Royal Navy have undergone during the Present Century, in respect of Dimensions, Forms, Means of Propulsion, and Powers of Attack and Defence." *The Society's Silver Medal.*

To Monsieur Théophile Silvestre, for his paper read before the Society—"Les Arts, les Artistes, et L'Industrie en Angleterre, depuis la Dernière Moitié du Dix-Huitième Siècle Jusqu'à ce Jour." *The Society's Silver Medal.*

To Dr. J. Forbes Watson, F.R.S., for his paper read before the Society:—"On the Growth of Cotton in India, its Present State and Future Prospects, with Special Reference to Supplies to Britain." *The Society's Silver Medal.*

To Mr. Leonard Wray, for his paper read before the Society:—"The Culture and Preparation of Cotton in the United States of America, &c." *The Society's Silver Medal.*

To Mr. John Bell, for his paper read before the Society—"Some remarks on the application of Definite Proportions and the Conic Sections to Architecture, illustrated chiefly by the Obelisk, with some History of that feature of Art." *The Society's Silver Medal.*

SWINEY PRIZE.

This year brought with it the third quinquennial anniversary of the death of Dr. Swiney, and the Society, in accordance with the trust imposed on them by the will of that gentleman, have presented the Silver Goblet, of the value of £100, with the gold coin in it to the same amount, to Dr. Alfred Swayne Taylor, F.R.S., as the author of a treatise on Medical Jurisprudence. The goblet is in silver, from a design by Mr. Maclise, and was awarded at a joint meeting of the Members of the Society of Arts and the College of Physicians, held in accordance with the terms of Dr. Swiney's will, on the 20th of January last.

WRITING CASE.

It will be remembered that in the society's report of last year it was stated that the sum of £20, placed in the hands of the council by the Rev. F. Trench and J. MacGregor, Esq., to which the Council added the Society's Medal, as a Prize for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., had not been awarded, none of the articles forwarded having been considered to possess sufficient merit to justify a decision in their favour. The Council then announced their intention to invite further competition. In reply to this announcement twenty-eight cases were sent in, and after a careful examination by the committee they reported in favour of a case manufactured by Messrs. Parkins and Gotto, and the Council have thereupon awarded the prize of £20 and the Society's silver medal to that firm. The retail price of the case is 1s. 6d., including an indelible pencil, but without other contents, which must depend on the selection of the buyer.

FINANCIAL ESSAY.

At the date of the Council's last report, the essay sent in competition for the prize of two hundred guineas, placed in the hands of the Council by Mr. Henry Johnson, to be awarded as a prize for "The best essay on the present financial position of the country as affected by recent events, in which the principle of a sinking fund should be discussed, and also an investigation made as to the best mode of gradually liquidating the National Debt," were under consideration, twenty-two essays having been received. The prize has since been adjudged to Mr. Edward Capps, and the essay has been published. The adjudicators appointed by the Society to report on the merits of these essays were Professor Charles Neate, of Oxford, Professor Waley, of University College, London, and Mr. J. T. Danson, Fellow of the Statistical Society, and their decision in favour of Mr. Capps was unanimous.

MARINE ALGÆ.

The Council in their last report informed the members that no essays had been sent in to com-

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pete for the two prizes of £50 and £20, placed in their hands by Sir W. C. Trevelyan, Bart. That gentleman has now increased the amount to £100, and that sum is now at the disposal of the Council as a single prize for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on sea-weeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The essays, with accompanying specimens, must be delivered at the Society of Arts by the 31st day of December, 1860. Each essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which must also be written on a sealed letter containing the name and address of the author.

MONEY-MAKING AT THE ROYAL MINT.

No. V.

To visitors to the Royal Mint, perhaps the *last* process of the art of coining—the crowning blow to all previous manipulations of the precious metals there, is the most interesting. The weighing machines, with their delicate little forceps, wheels, levers, slides, glass counterpoise weights, and distributing tubes, are unquestionably beautiful, as their action is next to infallible; but they yield the palm, in one respect at least, to the coining-presses. The weighing machines, like Civil Service Commissioners, are capable of reporting upon the merits of candidates for public office, but they do not, like the coining-presses, qualify those candidates for passing current in the best as well as the worst society. Vain would be all past operations indeed without the impressed stamp of the coining-room. The rapid transformation of blanks into finished coins—the covering of their entire surfaces and edges with beautifully engraved devices in the twinkling of an eye, as it were, this it is which astonishes and pleases all who see it.

To describe as accurately as letter-press will allow the manner in which this important change in the complexion, and value, of the assized discs of gold is effected, is now our task, and we return for a moment to the four journey-weights of dried-out pieces. These are advanced to the coining-press-room, and whilst the officer is once more weighing, and the workmen are adjusting the presses for stamping them, we may endeavour to explain the general features of this department, and the mechanical appliances it contains.

The coining-press-room, then, is about 70 feet in length from 30 to 40 feet in breadth, and, it may be, 15 in height. It contains eight presses, ranged in a straight line, on the vertical screw principle, as constructed in 1810 by Messrs. Boulton and Watt, and these may be said to be at work almost every working day throughout the year. There is in addition a small hand-press, which does only two days' work in the year. The large power presses coin all the current monies for England and the Colonies—except Sydney, which has a small mint of its own—from the florin down through all denominations of silver to the three-halfpenny piece circulating in the West Indies; and from the penny to the quarter-farthing of Ceylon is copper. At the power presses, too, the great majority of the fine silver medals distributed among our noble-hearted and brave sailors and soldiers are struck, though in a different way to the ordinary coinage, as will be hereafter shown. The French toy-press produces only the silver Maunday monies given by Her Majesty or her agents to her pensioners on Maunday Thursday, according to ancient custom. As may be supposed, the coining-presses are very heavy castings—weighing very nearly two tons each. By far the greater portion of this metal, however, is thrown into the base of them. They are firmly bolted to foundations of granite of great depth and of immense solidity, and there is ample reason that this should be so. The beds of the presses, it is obvious, have much to withstand. Millions and millions of heavy blows are continually being struck upon these coiners' anvils, and it is certain that they would yield if not of immense strength in themselves, and well-sustained on their stony seats. At a height of about 2½ feet from the floor, which is of thick, narrow, oaken planking, so closely jointed and tongued as that the smallest coin shall find no crevice through which to disappear—at the height named, a platform covered with diamond-patterned iron plate, and with ample space on all sides of it for truck traffic, surrounds the eight presses. From this platform, at convenient distances for enclosing the presses, spring eighteen oaken columns of a foot square, reaching to the iron girders of an upper floor, and bound together laterally by hollow cross bars of cast-iron, with tension rods passing through them. The cross-bars perform a double office, they unite the columns in pairs, and support regulating buffers which limit the travel of the fly-arms of the presses. Taking now one of the tier of presses as illustrative of the whole, it may be stated that a coarsely pitched, say 5-inch, treble-threaded screw, of about 6 inches diameter, passes vertically through a gun-metal bush or nut in its centre, and leaves a space of say a foot between the lower end of the screw and the planed bed of the press. In this space the die-holders have to be arranged, and in this space all the money is struck.

To the lower part of the screw—and so adjusted as that its flattened end of hardened steel may work freely in a cup or dish, also of hardened steel, belonging to the upper die-holder—this latter is attached. The upper die-holder is supported by rods running quite through the body of the press vertically, and fastened to a collar working on the upper end of the screw. It is guided, too, by steel V pieces sliding over angles of the press, and it is clear, therefore, must rise and fall with any upward and downward movement of the screw. Firmly screwed down to the planed and perfectly level surface of the bed of the press, is the lower die-holder. This is recessed for the admission of the die, and is fitted with three "set" screws for fixing it accurately. The upper die-holder is similarly recessed in an inverted form, but the die once fixed in it is not adjustable. As the press-screw fits its "bush" or nut, and is made to move perpendicularly by adjusting brasses, above and below that bush, so must the upper die-holder and its die move perpendicularly also with it. It is only necessary, therefore, in die setting that the lower die be placed fairly below the upper one, which cannot fail to be rightly placed itself.

To the left side of the press is attached the feeding apparatus, a clever contrivance—now outshone, however, we believe, by a newly arranged "Layer-on," invented for the Calcutta Mint by Mr. Harvey, of that establishment—to which motion is given by means of a flattened vertical rod about three feet in length, working on a fulcrum pin passing through its centre, and the upper end of which slides in the slot of an eccentric quadrant clasping the circumference of the press screw. This feeding apparatus is furnished with a set of brass tubes of the various sizes of the money coined at the British Mint.

Well, then, if an engraved die be placed in the upper die-holder with its face downwards, another die in the lower with its face upwards, with a space say of an inch between the two, and a piece of gold be placed upon the surface of the lower one, it becomes plain that a forcible turn of the screw downwards will inevitably transfer impressions from both dies to the softened metal between them, and, in fact, make it a coin. And this, indeed—of a much ruder character, of course, than any machinery is now made—was the principle of Blondeau's screw-press, of that early period in Mint history when the hammer was superseded, and of which we have before spoken.

Imagining that the explanation so far is manifestly plain, let us take a stand upon the iron platform, and examine a little further into the arrangement by which continuous, rapid, and powerful motion will presently be given to this screw and its appurtenances. The golden blanks are distributed among boys who tenant square holes, fitted with seats, in the platform, and have wire meshed trays beside them for the reception of metal. These boys, however, must await our leisure before putting the blanks through the sovereign ordeal, and the rapid movements of the presses will no doubt atone for our delay.

The screw of which we have spoken, and which is the everything in the Mint coining press—except the life-giving dies—projects above the body of the press, and has fitted and keyed upon its conically-turned end, a pair of fly-arms. These are of about three feet radius, and have on their extremities hollow boxes of iron, which may be weighted according to the nature of the work expected of the press for the time being. These boxes are flat-ended, and fall upon the aforenamed buffers when the press is in action. From the centre of the fly rises a gracefully-formed trumpet-shaped hollow shaft, through the medium of which motion is transmitted to the press. The mouth of this trumpet is on the first floor, and we will therefore adjourn to that place. So! here are levers, rods, counterpoise weights, pumps, &c., and we are evidently behind the scenes. But let us look first to the mouth of the trumpet. This is about three inches above the floor, through which the trumpet shaft has passed, and between the iron girders of which brass bearings guide and steady it. A rod suspended to a vibrating beam overhead, runs down through the trumpet shaft, and is connected with the screw of the press. The other end of the vibrating beam has a rod depending from it, and which at its lower end on the same floor is attached to the piston of a vacuum-pump. The cylinder of this pump is in communication with a great vacuum-chamber—of which we must presently speak again—by means of a small pipe, and when exhausted the atmosphere presses on its piston with just sufficient force to make it balance through the beam the weight of the screw-pin of the press, its fly-arms, and upper die-holder. So perfect is this state of equilibrium maintained, that if we take up the trap in the floor, and ask the even youngest boy to move by its fly-arms the press he is attending, we shall find that he can do it with the most perfect ease. The fly-arms are made to stand still indeed by these means at any point of the stroke of the press desired. This is a great convenience in setting the dies. The press may be moved up or down with the completest readiness, and thus hand-tests may be made of the work, and impressions of the dies taken before the power is applied.

A notched rectangular lever of wrought iron, of considerable strength, and say twenty inches in length, is keyed upon the projecting upper end of the trumpet shaft, and lies close to the surface of the floor. The lever has a sliding steel box fitted upon it, and this is furnished with a key by which to fix it at any distance from the centre of the press as less or more power is required to be transmitted, or as, in fact, small or large monies are in the process of manufacture. Through this box, too, a shifting steel pin passes, and this allows a connection to be made with a horizontal rod of wrought-iron working *over a guide* immediately above the floor, and attached to a "horse-head" crank with a rod and vacuum-pump and great vacuum-chamber beneath it. Here, then, it will be seen that the communication is made perfect with the reservoir of power—as the vacuum-chamber is, although, as the "used-up" traveller said of the dome of St. Peter's, "there is literally nothing in it." We will now descend therefore once more, and after examining the arrangements of the vacuum department, will induce the boy so patiently awaiting in his hole our coming, to put a press in motion.

The vacuum-chamber is a cylinder of cast-iron about sixty feet long and two feet in diameter, and is placed horizontally parallel to the tier of coining presses, from which a wall separates it. From this reservoir—if we may so name it—arise

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at intervals corresponding with the distances of the presses from each other and with their number —that is, eight—a series of three-inch pipes, fitted with indexed stop-cocks intermediately to the vertical vacuum-pumps to which their upper flanched ends are bolted. The press-pumps are fitted with one disc valve opening into the vacuum-chamber and another to the great atmospheric ocean itself. There are communicating lines passing through tubes—and which lines hungry Mint-mice have been known to gnaw through during the night—to the press-holes, and these lines give the attendant sprites who convert buttons into sovereigns control over the inner and the outer valves. We now see that all is ready and we will return to the coining press-room. The patient and industrious boy we see has amused himself whilst waiting for us by repolishing all the brightwork about the machine until it shines like the bars of a palace grate—good boy!

He has also charged the tube of his feeding apparatus with some of our old friends, the blank pieces of gold. The tube has two grooves down its sides, and these enable him to drop *rouleaus* of blanks *flatly* into it with ease. Now observe, the dies are in their places, one above and one below, and like two seals—not those of the Arctic Seas, but letter seals—are ready to impress on both sides any softer material that may be made to interpose between them at the moment that power is applied to bring them together. The attendant now stands for a moment on the platform and puts the press up, where perforce of upstairs pump it remains; he next causes the feeder to clasp one piece from the bottom of the tube—and more than one at a time cannot find room to pass out—and to carry it forward to the lower die. It is placed so exactly as to cover the Queen's "image and superscription" completely. The vertical rod, worked by quadrant aforementioned, is now attached to the feeder in so simple a manner as to disengage itself readily if by any chance a distorted blank objects to leave its tube or be stamped upon, and *one* of the starting lines is pulled by some little force—the resistance of a small spring having to be overcome—and fastened to a stud beside the boy in the press-hole. Nothing moves as yet, and the fastening of the line has merely allowed a tappet to close the *outer* valve of the press-pump. Now behold! the Genii of the press-room touches another cord—not *chord* —and the effect is miraculous; he has opened the inner valve, and hey, presto! the air below the piston has vanished and the atmospheric column has carried it *instanter* to the bottom of the cylinder. The press-screw has followed by dint of rods and levers; and as an interiorly milled steel collar which nicely fitted over the neck of the lower die and rested on a tripod spring arose by force of that spring and encircled the piece of gold at the moment that the upper or reverse die struck it, it is clear that both the head and the tail, and also the serrated edge or milling were given to the blank at that one blow. The milled collar acted a double part indeed, it prevented the undue and irregular expansion of the gold as occurred in the old sledge-hammer coinage, and it formed a mould from which the edge of the sovereign became by sheer pressure within it serrated. Whilst the first of our batch of sovereigns was getting its impressions, the feeder slide came back self-actingly and singled out another piece; this it now carries rapidly forward to the die, and as the milled steel collar has been made—also self-actingly—to sink again below the surface of the die, the coined piece resting on it is unceremoniously pushed away by the new comer and thrown down an inclined copper slide in a finished state, to a tray placed to catch it and its lovely companions. The feeder now makes its deposits of piece after piece with wondrous precision, the collar alternately rising and falling, the boy keeping up the supply of food to the hungry "critter" who disposes of his golden rations at the rate of from sixty to seventy pieces per minute, and bright, beautiful, glistening, tempting, mischief-making, useful sovereigns are thrown off with marvellous speed. The levers, springs, weights, counterpoises, valves, and other portions of the vacuum arrangements go on with their task so long as the press attendant keeps the line on the stud beside him; but, wishing to stop all, he has nothing to do but release it, and his money-making forthwith ceases.

When an accumulation of coins of some magnitude occurs in the tray, and this is soon, they are taken up by workers in attendance, and carefully examined to see that they are free from spot or blemish, and fit to pass forth into the "wide wide world" on their mingled missions of good and evil.

THE SEWING MACHINE:

A SKETCH OF THE HISTORY OF ITS USE.

No. II.

THE sewing machine is used either to ornament fabrics or to unite them.

During the first half of the present century several machines, designed chiefly for ornamenting fabrics, were invented in England and France; and a considerable number must have been introduced among the embroiderers, lace-makers, glove-makers, and stay-makers of both countries. Between the years 1844 and 1850 a few machines for uniting fabrics by means of a running or basting stitch were used by bleachers, dyers, umbrella-makers, and others, for the purpose of tacking materials together. The number of machines of all kinds, however, at work in Europe in 1850 must have been so few that the name of a sewing machine could scarcely have been known even in manufacturing towns like Nottingham in England, or Lyons in France.

In the United States, sewing machines were first introduced into public notice and general use. The Americans needed machinery for uniting fabrics rather than for ornamenting them. So great was the need of machines for plain sewing that improvements were made at different places almost simultaneously; and even now, after years of litigation, it is impossible to decide with certainty who was the first inventor in America of any considerable improvement in the sewing machines. During the years 1850, 1851, and 1852, the three largest manufacturing establishments in the United States commenced business, and for several years they almost monopolized the trade. The high price of hand-sewing had prepared the people to welcome their machines; while their competition and extensive advertising soon overcame the hostility of the working classes. Sewing by machinery became, in a short time, a more important branch of national industry than either spinning or weaving by machinery. Manufacturers of boots, saddlery, and clothing of every description were the first to patronise the new invention. At present there are many large establishments in which between 100 and 200 machines are used in shirt-making, quilting, dress-making, &c. In the Southern States machines are used extensively to make negro-clothing. Within the past two or three years families have commenced to purchase them for domestic use, and already the sewing machine has become almost a necessary article of household furniture. Steps have been taken in many places toward their introduction into the female departments of the public schools, as a part of the regular course of study, and it is considered far more desirable that young ladies should understand the proper manipulation of a sewing machine than that they should become good pianists or indifferent artists. In some neighbourhoods one family will purchase a machine and hire out the use of it to persons not rich enough to own one, or several families will unite in the purchase of a machine, and pass it around as needed. Many seamstresses who, at first, borrowed money to buy one, now own two or three, having other seamstresses to work those for which their own hands do not suffice. Full one-half of the machines now made are sold to the laborious class of persons known as needlewomen, sewing girls, and *employées* in manufacturing concerns. It is not extravagant to say that three-fourths of all the sewing done in the city of New York is executed on machines—so profitable and so popular has this work become.

As a consequence of this rapid introduction and extensive use of sewing machines, a great improvement has taken place in the quality of machine needles, sewing silk, twist, thread, &c. The Americans now boast that they can produce thread far superior to any of foreign manufacture in strength and evenness of texture.

Since 1850 the sewing machine trade in Great Britain has merely followed, though at a great distance behind, the course of trade in America. Probably one fifth of all the sewing machines used in this country have been imported from the United States. Almost all the machines in use are owned by manufacturers of shirts, boots, stays, caps, saddlery, and ready-made clothing. Its use is confined to places of large trade, such as London, Manchester, Nottingham, Glasgow, the north of Ireland, Dublin, and Limerick. The prices of machines have been so very high that few, or almost none, are owned by the working classes; and probably this is the principal reason why the workmen resist their employment. A "family sewing machine" is almost unknown in Great Britain.

Since our last issue, we have been informed that one of the first patentees of the sewing machine in Great Britain has withdrawn the suit which he had commenced against some manufacturers of ready-made clothing who were using the machines of another patentee. We are pleased to find he has pursued, in this case, the wiser policy of paying the expenses already incurred in his prosecution, rather than meet a final defeat in attempting to control the sewing machine trade of England. We may now hope that the people of England will be permitted, without molestation, to select from the best machines that can be brought into the market. Patentees should endeavour to settle their disputes among themselves without quarrelling with their customers.

Literature.

High Speed Steam Navigation and Steam-ship Perfection.—Can perfection be defined in the form of a Steam-ship, a Propeller, or any other mechanical appliance? A proposition for the solution of the Scientific World, and for the consideration of th British Admiralty. By ROBERT ARMSTRONG. London: E. F. Spon, 19 Bucklersbury, E.C. 1859

THIS production, with its very attractive and particularly mysterious title, reminds us forcibly of a narrative which must be familiar to the most incipient entomologist, beginning—"Will you walk into my parlour, said the spider to the fly? 'tis the prettiest little parlour that ever you did spy: the way into my parlour is up a winding stair, and I have many curious things to show when you are there;"—for we know of old that Mr. Armstrong is very liberal in his invitations to the "scientific world," the "British Admiralty," and other acquaintances of his to walk into his parlour ("parley"); that the way into it is an extremely round-about one; that the things he has in it are exceedingly curious; and finally, that when he once gets you into his mazes and meshes it is a most difficult thing to extricate yourself from him. Indeed, the faculty which Mr. Armstrong has for spreading words and figures in complicated forms is so wonderful that, were his knowledge of geometry and his love of symmetry equal to the spider's, he would almost stand upon a level with that clever creature in the art of spinning webs. We must do him the justice, however, to say that he is void of that cruel and selfish disposition which his little rival so wantonly manifests.

There is, to speak more gravely, a very true sense in which the man who writes and publishes a book invites the reader into his parlour—his "parlour" being that mental region or apartment in which he dwells. The knowledge which

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a man possesses constitutes the furniture and decorations of that apartment, and it is by means of it that he proposes to entertain the reader. If, therefore, on entering the apartment we see at a glance that the whole aspect of the place is uninviting or repugnant to us, it is only wise of us to retreat forthwith. And this, we must say, is the purpose we have formed in reference to Mr. Armstrong. We do not like his "parlour" at all; his furniture is all rickety and unsound, and his decorations coarse and extravagant. We do not find in his writings any clear understanding of existing science; any sufficient appreciation of the present condition of our knowledge; any orderly statement of what he presumes to be erroneous; or any systematic endeavour to explain his own theories. Nor, indeed, do we even find any indication of the mental power and culture which are indispensable in a man who presumes to handle such a subject as that on which Mr. Armstrong here addresses us.

We write this without a shadow of ill-will to Mr. Armstrong, and with the hope that he will not persist in estranging all sound scientific men from him. That he is now running the risk of this is most evident. Months ago Mr. G. P. Bidder openly repelled him at the Institution of Civil Engineers, saying that he (Mr. Armstrong) was either so insensible or so indifferent to the arguments of the cultivated members of that Institution, that further argument with him "would be as useless as to attempt to hold a conversation with him in a language he did not understand;" and Mr. Armstrong himself innocently tells us that "an eminent engineer has used precisely the same words." We not only adopt them, but go further, and say that scientific men who converse with Mr. Armstrong do actually employ a language which he does not understand. And the reverse is equally true—scientific men do not understand his language. He makes a very free use—too free a use—of certain great names, but we believe he fails altogether to comprehend what the persons whom he quotes mean in much that they say. Our opinion is, that he is wholly mistaken in supposing that he is in any way competent to deal with the subjects on which his mind appears to have fastened. We do not for a moment doubt the excellence of his intentions, be it observed; it is of his inability to give effect to them that we speak, and of that alone.

The Polymeter, or Quintant. The Practice of a New Sector, as used in Trigonometry, Surveying, Fortification, Gunnery, Engineering, and Astronomical Observations. By FREDERICK R. A. GLOVER, M.A., Chaplain to Her Britannic Majesty's Consulate at Cologne. Cambridge: Deighton, Bell, and Co. London: Bell and Daldy. 1859.

THE author of this little work is the inventor of an instrument called the Polymeter, which is represented as answering all the purposes of—1, a sextant; 2, a double sextant; 3, a surveying magnetic compass; 4, a level; 5, an artificial horizon; 6, a dial; 7, a set of scales; 8, a protractor; 9, a thermometer; 10, a gunner's quadrant; and 11, a pair of callipers—the whole being brought into the size and shape of a thin memorandum book, which its cover forms. In addition to all this, it likewise is a "trigonometer"—a new instrument for measuring heights and distances, doing trigonometry without logarithms, &c. The pamphlet before us is a handbook for the use of those who are fortunate enough to possess this invaluable instrument, and must, of course, be purchased by all such persons. To those who do not know the instrument the pamphlet will make its nature and value known.

Chart of the Royal Navy of Great Britain from the Earliest Period of History, Compiled from Historical Publications, Old Records, Parliamentary Returns, and other Authorities. London: J. D. Potter, 31 Poultry, and 11 King-street, Tower-hill. 1859.

THIS chart, which has been compiled, we believe, by Mr. Frederick Perigal, exhibits at a glance the rise and progress of the Royal Navy, showing its total force in each reign, and the numbers of ships in the several rates since the system of classification was adopted by Charles I. The relative strength of the navy at the principal periods of our history may, therefore, be readily compared by means of it. The sheet has been very carefully printed by Messrs. Eyre and Spottiswoode, and is issued either unmounted, or mounted and bound strongly in cloth. We cannot vouch for the accuracy of the compiler, as he has not thought fit to verify his figures by distinct references to the sources from which he has drawn them, and we know how easily mistakes may be made in such matters. We see no reason, however, to question Mr. Perigal's care in this respect, and we know that he has for some years made the navy a subject of study. For general purposes such a compilation as the present will be very useful.

VAN HECKE'S SYSTEM OF VENTILATION.

MUCH attention having lately been drawn to the system of ventilation lately introduced by Van Hecke in many continental hospitals—apparently with great advantage—we have been anxious to lay some correct description of the system before our readers. This, an article in last week's number of our excellent contemporary, the *Builder*, opportunely enables us to do.

"Of the application of Van Hecke's plan to one of the pavilions of the Hospital Beaujon, and a highly favourable report by a Government commission on the subject, we had some time since heard, and were favoured," says our contemporary, "by Mr. J. Bonomi, with a special translation of an elaborate paper by the reporter on that commission, Dr. Grassi, who had instituted an experimental investigation of the system for his own satisfaction, after the commission of which he was the reporter had favourably reported on it to the French Government. Of this translation we propose now making some use; the more especially as we find that Van Hecke's mode of ventilation continues to be preferred to all others in new French hospitals, to which it has since been applied."*

Dr. Grassi, in the outset of his dissertation, after some allusion to the modes of ventilation and warming long in use at the Hospitals Neckar and Beaujon, and to the commission appointed to examine the new system of Dr. Van Hecke which has been tried in the Pavilion No. 4 of the Hospital Beaujon, thus proceeds to describe that system:—

"The warming of the Pavilion No. 4 of the Hospital Beaujon is performed by means of a calorifère-stove situated in the cellar-floor. Air is conveyed to this stove by a cylindrical channel of zinc, 75 centimètres (2 ft. 5½ in.) in diameter, which, after running horizontally through the vault, is received into a vertical shaft of masonry opening out in the garden at about 2 mètres (about 6 ft. 7 in.) above its surface; from this source the air is derived. After the air has passed through the tubes of the calorifère and become warmed, it enters a large pipe, to be distributed by it in the three wards (one above another): before, however, reaching them, it passes over a pan of water to supply it with a suitable quantity of moisture. By this arrangement the air transmitted to the wards is derived exclusively from the garden, and not allowed to mix with the air of the vault. Instead of permitting the air to circulate in the calorifère, it may be sent to the wards in a direct course, which bears the same relation to the channel of the calorifère that the chord does to its arc. At the commencement of the calorifère tube there is a moveable register for the purpose of giving such a direction to the air as may be required, either for warming it, or allowing its use at its natural temperature. The register, when partly opened, may even permit a mixture of the two at different degrees of temperature, and moderate the warmth of a ward for the moment become overheated. The air conduit (or pipe) enters the ground-floor ward in its centre at the floor level, through the middle of a cast-iron drum of four vertical sides, furnished with perforated doors for admitting the air into the ward. The tambour or drum incloses some wire shelves, on which linen may be placed, and drinks for the patients to be warmed. The air-pipe debouches on the floor-level through an opening of 75 centimètres (2 feet 5½ in.) diameter, in which is inserted a vertical tube of 60 centimètres (1 ft. 11½ in.) diameter, rising to the first floor; between these two tubes there exists an annular space, permitting a portion of the air to be arrested on the ground-floor. Thus the air introduced is divided into two portions; one admitted to the ground-floor, the others continuing upwards for the use of the upper floors. A register, regulated by a quadrant, permits the reduction of the section of the tube, and of varying the volume of air for each of the floors. If the register is entirely closed, the whole of the air would be arrested on the ground-floor: by opening it, more or less, the air for the two upper floors is increased at pleasure. On the first floor there is an arrangement like that on the ground-floor, a register for stopping a certain volume of air, and for allowing the rest to rise to the second floor, where the second column terminates, and a tambour only exists, in every respect resembling those of the lower floors. Thus fresh air, serving both for warming and ventilating, is admitted into the centre of the wards, entering through wide openings, so as not to acquire a great velocity, and produce disagreeable currents. The air which has been harboured (*séjourné*) in the wards escapes from them through four evacuating channels in their corners or angles—a number too limited, in my opinion; but the pavilion being already built where the system of ventilation was adapted to it, a greater number would have occasioned a considerable outlay for cutting chaces in the walls, or for placing the channels on the wall surfaces with a very disagreeable appearance. The three channels at each angle,* and which correspond with the three wards, rise side by side vertically to reach the loft, where they are received into a horizontal zinc pipe, one at each of the four corners, which unite in the centre of the loft in a tambour, capped with an evacuating cylinder of zinc, 75 centimètres (2 ft. 5½ in.) in diameter. At the intersections of the air-escape channels from the wards with the receiving channels of the loft, registers are fixed, by which the openings may be regulated, and, consequently, the draft or extraction from each of the wards. The air from the wards has, besides the evacuating channels above-named, an exit for escape through the water-closets by an opening in the ceiling, which also communicates with the channel in the loft. The air from the ward, entering into the water-closets through an opening in the lower part of the door, rises towards the evacuating opening in the water-closet ceiling, sweeping through and carrying away in its course all smell. The ventilation is not effected through the water-closet basins, as at La Ribosière, the seats being closed, and the ventilation acting exclusively upon the atmosphere within the water-closet; it is quite sufficient, and in no hospital have I found the water-closets so completely rid of smell as in the Hospital Beaujon.

"By way of concluding what refers to the introduction and exit of air, I must mention a source of pure air considered as accessory, which, however, is not unimportant:—On the ground-floor at the entrance to the cellaring is placed a small steam-engine, of which I shall presently speak. The smoke-flue from its furnace, united to that from the calorifère-stove, is surrounded by a concentric enclosure, the lower end of which is

* A pamphlet entitled "Remarks on Ventilation, with Extracts from Official Reports, on the Combination of Ventilation and Warming;—System Van Hecke. By Wilson Weatherby Phipson, C.E." (Printed by H. M. Pollett, 35 Aldermanbury), has recently been forwarded to us, which contains many allusions to the favourable results obtained by means of Dr. Van Hecke's system, but no particular description of the plan itself.

* It seems needful to add here, "of the upper ward." TRANS.

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open to the outer pure air, and draws it in through its orifice in the garden. This air circulates in the annular space round the smoke-pipe, in contact with which it becomes warm as it rises to the top of the building. This air-flue is situated in the thickness of the wall separating the staircase from the wards; at the level of each story it presents three openings, one into the ward, one towards the stairs, and the third into the two-bedded room. These openings afford a passage for the warm air during winter: in the summer season it is allowed to rise to the upper part of the building, where it disperses itself; but Mr. Van Hecke was desirous to turn this warm air to account, by causing it to enter the loft used as a drying-chamber. When the upper orifice of this air-funnel is closed, as is the case in winter, the warm air diffuses itself in the wards, and in the staircase, of which it keeps up the warmth. In summer, when the upper orifice is entirely open, the smoke-flue draws upon the air within the wards, and thus produces an increase of ventilation.

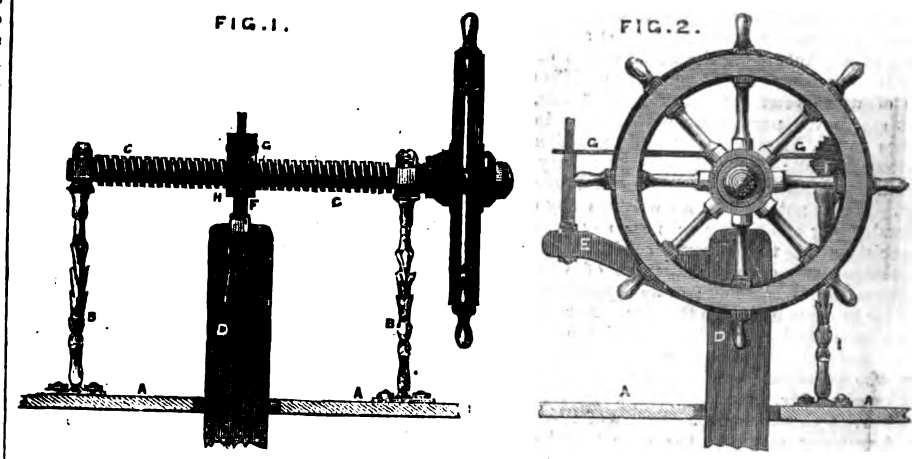
"Such is the channel-system for the passage of the air derived from the garden, and finally escaping through the common flue. Now let us consider the moving power. I have before mentioned the small steam-engine at the entrance to the cellaring; it is intended to keep in motion a ventilator, which, in the first instance, Mr. Van Hecke had placed in the upper part of the tubing within the flue or chimney of the loft. A band or strap transmits the movement from the ground-floor to the loft; the ventilator then produces a suction-draft from the air of the wards. The apparatus of Mr. Van Hecke produced ventilation by (*appel*) suction by mechanical agency. Since it was fixed an important addition has been made to it. Mr. Van Hecke has placed a second ventilator, identical with the first, in the lower indraught channel, where the column of air takes its rise within the vault. On connecting this ventilator with the machine, it drives into the wards the air which it inspires from without, and thus produces a ventilation by injection analogous to that produced by the apparatus of Messrs. Thomas and Laurens, at the Hospital La Riboisière. In this manner the apparatus is arranged to allow of ventilation by suction, on putting the upper ventilator in motion, or by injection when the engine is in connection with the ventilator situated in the lower part of the building; the change being effected simply by the band which transmits the motion, an operation requiring but a few minutes. The ventilator of Mr. Van Hecke is composed of two (*palettes*) fans or blades, fixed to two stems, which are inserted perpendicularly on the axis of rotation, and inclined from fifty to sixty degrees. A peculiarity distinguishing this ventilator is, that the inclination of the fans is not constant, but varying with the speed of the rotary movement. The boiler of the engine warms the office on the ground-floor, in which are arranged pans for poultices, and a warm-linen closet. A portion of the steam, after giving motion to the engine, is sent to the upper floors, where it heats the water required by the patients; but the greater portion, which might be usefully employed, is for the present wasted."

Dr. Grassi then proceeds to show how the effects of the system are indicated by anemometer, connected with a contrivance of M. Van Hecke's. He then adds:—

"In order to complete the description of this system of warming and ventilating, I have to notice an apparatus not yet fixed, but which is now being constructed by M. Van Hecke, and to be placed within the stone-built channel, which from the cellar leads into the garden for air. This apparatus is intended to cool the air in summer, on its way to the wards. It consists of two cylinders placed horizontally one above the other, at 1 m. 50 s. (4 ft. 11¼ in.) apart. On the axis of the upper cylinder is a pulley to receive the movement of the axletree. The under cylinder is plunged into a trough of water, which may be obtained of the temperature of well-water, or be cooled artificially by pieces of ice, should it be requisite. Endless bands pass from one to the other of these cylinders, which revolve simultaneously. The air circulating in the channel is forced to pass over these constantly moist bands, and thus acquires a much lower temperature."

The use of steam-power, we may add (says the *Builder*), is only requisite to Van Hecke's system on a large scale. In ships and elsewhere, where manual labour can be easily or economically applied, or is sufficient for the purpose in view, no steam-power is necessary to ventilation on this plan; and in dwelling-houses the ventilator has even been put in action by clockwork and weights. A French admiralty report speaks favourably of the system as applied on shipboard, where one man works it at a time. French Government reports speak strongly in its favour, as adopted at the Hospital Necker, for ventilation, heating, and cooling. The Hospital L'Asile Imperiale de Vesinet, near Paris, has had Van Hecke's apparatus applied to it, and it has been brought into use in other hospitals and public buildings in France and elsewhere, and is ordered for hospitals now in course of erection at Chartres, Lyons, &c.

GIBSON'S PATENT STEERING APPARATUS.



MR. W. GIBSON, of St. Leonard's-road, Middlesex, has just obtained patents in England, France, &c., for a steering apparatus of novel and promising construction. His invention consists in working the rudders of ships and other vessels by means of an endless screw shaft, which gives motion to a nut connected to a lever centred on a fixed stand-end at one end, and connected at the other end to an arm projecting from the rudder head, through a conecting rod. The steering wheel is keyed on or otherwise fixed to the endless screw shaft, and on turning the wheel in one direction or the other the required motion is communicated through the nut, lever, connecting rod, and arm to the rudder. The lever is slotted to allow of the connections and the nut and the rudder arm moving therein.

Fig. 1 of the accompanying engravings is a view of this apparatus taken from the side of a ship or vessel; Fig. 2 is a front view of the same. *A* is the deck upon which are firmly fixed by bolts or otherwise two standards *B B*, carrying bearings, supporting a screw *C*; *D* is the rudder-head or post, and *E* an arm or lever projecting from side thereof; *F* is a vertical rod carried up from the arm *E*; on the upper end of this rod a small roller is placed, which rides in a slot in one end of the lever or bar *G*. The opposite end of this bar or lever is centred in a pin or stud supported on a standard *I*. The lever *G* is also slotted, and in the slot a pin rising from and connected to a nut *H* works; a friction roller is placed on the pin, where it moves within this slot. The screw *C* passes through the nut. On the tiller-wheel *K*, which is keyed on one end of the screw *C*, being turned, the nut is moved to or fro, moving with it the lever *G*, which through the rod *F* and arm *E* turns the rudder.

SHAND AND MASON'S NEW STEAM FIRE-ENGINE.

SOME interesting experiments were made on Friday last at the Waterloo-bridge-wharf, with a view of testing the efficiency of a new steam fire-engine which has just been completed by Messrs. Shand and Mason. This engine is the second of the kind that has been made, but in the construction of the present such a considerable reduction of weight has been effected as to materially extend its sphere of usefulness, while it is anticipated that others of still lighter proportions may be built. The whole machine is mounted on high wheels, with a fore-locking carriage, and is, of course, intended for rapid transit by means of horses. The box contains the hose and implements, with a driving seat and space for firemen. Its extreme dimensions are 12½ feet long by 6 feet 5 inches wide, and 8 feet high without chimney. The total weight, including firemen and all implements, is nearly three tons, or almost double the weight of the ordinary Brigade engine. This increase of weight is apparently the only disadvantage which it possesses when compared with the common Brigade engine; in all the other and more important qualities the superiority of the steam fire-engine is so great as to leave no room for comparison with any other. Like the common fire-engine, this one by steam can be worked either with a suction pipe, or water may be drawn from the cistern, which forms part of the engine itself. The steam cylinder and pumps are made entirely of gun-metal; the valves of india-rubber, as in the floating steam fire-engine; and the whole machinery is of the simplest and strongest construction, and not liable to be damaged by any amount of jolting over rough roads. The boiler is of the upright tubular construction, affording ample means for superheating the steam; there are 199 brass tubes, 1¼ inch outside diameter, and 15 inches long. The fire-box is of copper, 3 feet 4 inches diameter; the cylinder is 8¼ inches diameter, with 6-inch stroke; one water cylinder is 6 inches diameter with 6 inches stroke, the other 7¼ inches diameter with a 4-inch stroke, the two being equal in cubic contents. In designing this engine other important circumstances besides obtaining the best theoretical steam pump have had to be taken into consideration, such as weight, bulk, means of transit, and accommodation for hose, implements, &c. The London Brigade engines have pumps consisting of two single-acting cylinders, 7 inches diameter and 8-inch stroke. The average rate of working at fires is not more than 40 strokes per minute, and, as the cylinders contain 616 cubic inches, it follows that a London brigade engine delivers, at its average rate of

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SAMUEL AND NICHOLSON'S PATENT PADDLE-WHEEL CONDENSERS FOR MARINE ENGINES.

FIG. 1.

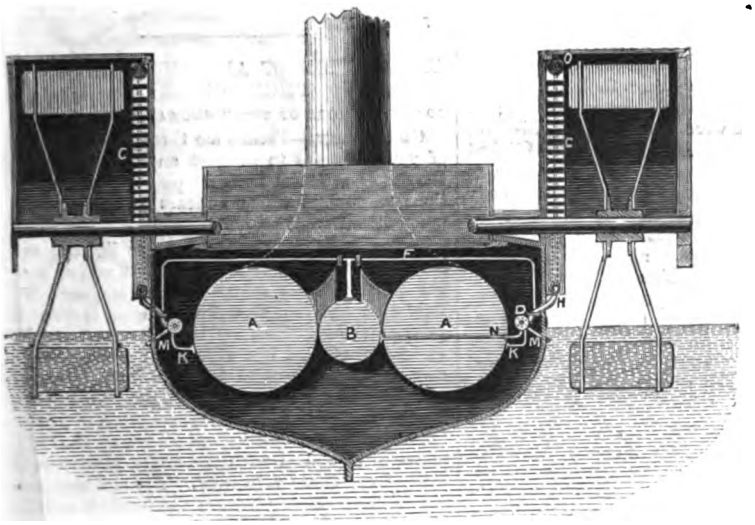
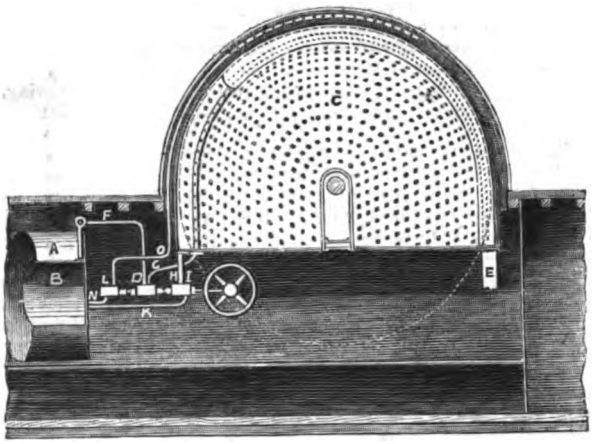


FIG. 2.



working, 88 gallons per minute, being worked by 28 men. The water cylinders of the steam fire-engines contain 340 cubic inches, and, as it can be readily worked at no less than 218 strokes per minute, it will thus be equal to three Brigade engines at their ordinary rate of working. The rapidity with which steam can be generated is, of course, an important point in the construction of a machine required for duty on the most sudden emergencies, and this point had been well and satisfactorily ascertained before the trials of Friday last. Nevertheless, in the course of the experiments it was demonstrated that a pressure of 10lb. steam could be generated in six minutes from the moment of lighting the fires; a high pressure was obtained in 10½ minutes, and the engine was immediately in full work. Of course, in the case of an engine of such description being generally adopted, the fires would always be kept laid, and lighted while the horses were being harnessed; so that the whole machine would be in full motion on its way to a fire. Before the trial the boiler was overcharged with water, part of which was run out before the fire was lighted and found to be cold by the spectators. The jets used were ⅝, ¾, and inch, in succession, the changes being accomplished by means of a stop-valve on each of the two lines of hose without stopping the engine. This feature will be of great use at a fire. A mast was placed on the bridge, the height from high water to top of mast being 82 feet; the height attained by the ¾ jet was considered to be 145 feet, and the horizontal measured distance 168 feet; the inch jet went 120 feet perpendicular and 50 feet horizontal. Gentlemen from the various insurance companies, and others interested in fire-engines, were present.

At 6 P.M., on the 6th inst., a second trial took place at the South Kensington Museum, in the presence of Mr. Dilke, Mr. Cole, Captain Fowke, Mr. Braidwood, and other scientific gentlemen. The engine was started under a pressure of 25lb. in 9 minutes from lighting the fire. The only indicator of height was a tree 70 feet high. The jet was considered to be 150 feet in height, and the inch 130; the measured horizontal distance was 168 feet with the inch jet. It was considered by those who were present at both trials that the engine worked better at the second trial than at the first.

HOLYHEAD AND LIVERPOOL TELEGRAPH.—The submarine cables connecting Holyhead with Liverpool have been successfully laid by Messrs. Glass Elliott, and Co., for the trustees of the Mersey docks. The old semaphore system, which has been in use up to the present time, will be immediately superseded by electric communication between these important points.

SAMUEL AND NICHOLSON'S PATENT PADDLE-WHEEL CONDENSERS FOR MARINE ENGINES.

MR. SAMUEL, C.E., of Great George-street, Westminster, and Mr. Nicholson, engineer, of Bromley, have together obtained a patent for a very novel kind of condenser for marine steam-engines. Their improvements relate to such engines as are employed to drive or to work in the neighbourhood of paddle-wheels, water-wheels, or other apparatus by which the agitation and dispersion of cold water are produced in their ordinary working. We will describe and illustrate the improvements more particularly with reference to their application to paddle-wheel steam vessels.

The invention consists primarily in the employment of surface condensers of any approved form within the paddle-boxes, or otherwise by the side of or behind the paddle-wheel, in order that the water which the wheel, while in motion, is continually throwing up may be received upon or come in contact with the exterior of the condensers and effect the condensation of the steam within them. The invention further consists in employing a supplementary or donkey-engine for pumping the feed water into the boiler or boilers, and a supplementary boiler, or boiler compartment, for generating from the salt water of the sea sufficient steam to supply, when condensed, the waste of water which occurs by leakage in the main engine and by other causes of loss. The feed pumps of both the salt and the fresh-water boilers may be worked by the donkey-engine, which is itself ordinarily driven by steam from the salt-water boiler by preference. Air pumps may thus be dispensed with, as the condensed steam from the surface-condensers falls by its own gravity to the feed pumps. It is evident that where a screw-propeller and paddle-wheels are used in the same vessel, the condensation of the whole of the steam used for giving motion to all of them may be effected by means of this improved arrangement of condensers in connection with paddle-wheels.

Fig. 1 is a transverse section of so much of a paddle-wheel steamer as is necessary for the explanation of the manner in which they prefer to carry the invention into effect; Fig. 2 is a longitudinal section, showing the condenser and arrangement of boilers and donkey-engine; *A A* are ordinary boilers; *B* is a supplementary salt-water boiler; *C* is the condenser formed of side-plates *a a* and top and bottom plates *b b*; *c c* are a series of tubes open at both ends, and fitted steam-tight between the plates *a a*; *D* is a donkey-engine; *E* the exhaust pipe leading from the cylinder into the condenser; *F* is the steam pipe leading from the salt-water boiler *B* into the donkey-engine; and *G* exhaust pipe conveying the steam from the donkey-engine into the condenser; *H* is a pipe for supplying the fresh water from the bottom of the condenser to the feed pump; *I* from whence it is pumped through the pipe *K* into the fresh-water boiler; *L* is the pump for supplying salt water introduced through the salt-water supply pipe *M* to the boiler *B* through the pipe *N*; *O* is a cold-water pipe for the condenser to be used at starting until the paddle-wheel has commenced to throw the cool water up to the condenser.

ROYAL AGRICULTURAL SOCIETY'S SHOW.

THE Royal Agricultural Society has issued the following programme of their proceedings at the ensuing Warwick meeting:—

TUESDAY, July 12, and WEDNESDAY, July 13.—The implement yard open from ten o'clock in the morning till six o'clock in the evening, on Tuesday; and from seven o'clock in the morning till six o'clock in the evening, on Wednesday; at an admission-charge of 2s. 6d. for each person. Machinery will be shown by the exhibitors at work on each of these days.

The judges to inspect the live stock, and to award the prizes.

Public trials of the steam cultivators on land in the neighbourhood of the city during such hours as the stewards may determine.

At one o'clock (or as soon after as all the judges shall have delivered in their awards, of which notice will be given) the public will be admitted into the cattle-yard on the payment of 5s. each person, at the special entrances; members of council and governors of the society being admitted by tickets to be purchased at the finance department of the society at the show-yard; and exhibitors of live-stock on producing their exhibitor's ticket. Arrangements have been made for distinguishing the animals that have won the prizes immediately the judges have made their awards. At eight o'clock in the evening the cattle yard will be closed.

THURSDAY, 14.—The general show-yard of cattle, horses, sheep, pigs, and implements open to the public from six o'clock in the morning till six in the evening; admission 2s. 6d. each person.

FRIDAY, 15.—The general show-yard open to the public from six o'clock in the morning till six in the evening; admission 1s. each person.

General meeting of the members in the Shire Hall at ten o'clock in the forenoon.

PRESIDENT.—His Grace the Duke of Marlborough.

STEWARDS OF DEPARTMENTS.

Cattle.—Mr. Robert Smith, Mr. Milward, Mr. W. Fisher Hobbs.

Implements.—Mr. Barnett, Mr. H. B. Caldwell, Mr. E. Pope, (Lord Leigh, Steward-Elect).

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Cheese and Wool.—Mr. Thomas Pain.

Finance.—Mr. Raymond Barker, and Mr. Wilson (of Stowlangtoft).

Show-Yard Refreshment.—Mr. Humberston, M.P.

Show-Yard Receipts.—Lord Portman, Mr. Wren Hoskyns, Mr. Torr, and Mr. Wilson (of Stowlangtoft); Mr. Milward, Mr. W. Fisher Hobbs.

General Arrangement of Show.—Mr. Brandreth Gibbs. By order of the Council,

B. T. BRANDRETH GIBBS,
Hon. Acting Secretary, *pro tem.*

By the regulations of the society all persons admitted into the show-yard, or other places in the temporary occupation of the Society during the meeting, shall be subject to the rules, orders, and regulations of the Council.

BOAT-LOWERING APPARATUS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Permit me to offer a few remarks on a letter of Mr. Charles Clifford which appears in your last number. Whether or no I be held competent to form a correct opinion on the subject, I would leave, with all due deference to the inventor himself, to the decision of those officers whose vessels have been fitted with his "lowering apparatus" for some length of time, rather than to those who have merely witnessed its working during the ordinary trials.

In the first place, with regard to the impracticability of adjusting the length of pendants to meet every contingency, I am ready to admit that the light-draught and the load-draught in a man-of-war vary but in a trifling degree with the ordinary consumption of coal; on the other hand, in large mercantile steamers such as those of the Peninsular and Oriental and Royal Mail Companies, which are constantly under steam, and carry an ever-varying weight of cargo besides, the difference is material. Setting, however, these circumstances aside, Mr. Clifford quite overlooks the chief drift of my argument, namely, that a ship when pressed by canvas may have a considerable heel at the time it is necessary to lower a boat from one side or the other; the weather boat will consequently be raised several feet higher from the water's edge than the opposite one; it is hardly necessary to add that no adjustment of pendants could be adapted to meet these ever-fluctuating changes during a sea voyage.

Again, I am asked with reference to the old plan of lowering with tackles which Captain Kynaston still thinks it advisable to retain—"What is to prevent one fall going by a run?" I may put a similar question—What is to prevent one of Mr. Clifford's "single pendants," which may work stiffly in the nip-sheaves, from going with a surge, and producing the same ill effects which the designer professes to avoid? It is true that both pendants being reeled upon the same cylinder will be released from it simultaneously; it does not, however, follow that they should traverse with the same facility through the sheaves, for the reason thus mentioned; one or the other may work stiffly for a while, and then become released with a surge, either carrying away with the jerk, or causing the boat to descend unevenly to the water's edge, as was fully exemplified in the last trial of the Exmouth, when the engines were stopped to avoid an accident. Mr. Clifford having desired me to produce an instance of a serious accident through the above cause, I am bound to give one. A few months ago Her Majesty's ship Renown was leading the line of the Channel squadron into Plymouth Sound, when a false alarm of a man overboard was raised; on this a crew jumped into one of the cutters, and a man had already commenced to lower, when one of the pendants broke with a surge, and the crew, gear, &c., were precipitated into the water, carrying away one of the davits at the same time; to remedy the disaster the opposite boat was ordered to be lowered, and, strange to say, precisely the same accident occurred, the davit, however, remaining entire.

With reference to another remark in Mr. Clifford's letter, I certainly cannot view it as an objection to Captain Kynaston's method of disengaging, when there are probably no less than twelve men sitting idle in a boat, that one among their number should be told off to let go a rope in case of need, which acts as a reserve, or a safety trigger, to meet the remote contingency of the proper disengaging line being foul, and therefore may be the means of preserving life; in short, having, as it were, two strings to his bow, is a manifest advantage, and I think Mr. Clifford will do well to consider this; for if his boats, as now fitted, be lowered from a vessel going at any speed, and one of the pendants be jammed, the crew have no immediate resource to save themselves from the imminent risk of destruction. Having made distant allusion to a catastrophe of this kind, and been called upon by Mr. Clifford to substantiate my statement, I will do so, though with some reluctance. In May last a written document came into my hand, which I have quoted word for word—"The ship Orwell, belonging to Messrs. Green, of London, had a boat fitted with 'Clifford's lowering apparatus.' In lowering the boat to pick up a man overboard, the fore-pendant hung when the boat was at the water's edge, and swamped her, drowning all her crew; this occurred on her last voyage to Australia." Every one would be glad to find this deplorable event contradicted, but unfortunately I have it corroborated also in writing on the testimony of Mr. Green's own officers by the hand of one of Mr. Clifford's staunchest allies, and I think it a pity, therefore, that the former should put himself so much out of his way to challenge or deny the truth of a statement which I fear does not admit of the shadow of a doubt, the more so that it is not in human nature that our best efforts should be infallible, and that Mr. Clifford's plan has been already instrumental in saving life.

To avoid similar disasters I certainly would not advise Mr. Clifford to practise the dangerous experiment for which, he says, his plan is so well adapted, that of attempting to drop his boat on the top of a wave which he may encounter during his descent, or during the roll of a ship; however free may be the working condition of his pendants round the roller and through their respective sheaves, it must be a sluggish wave indeed, or the ship must be an easy roller, whose rising or falling motion does not surpass the descent of a boat released under such circumstances by the lowering rope being let go—she will probably drop into the trough of the sea in any case, or if a pendant hangs or is carried away, a catastrophe will be inevitable. Captain Kynaston, whose mode of disengaging is instantaneous, and in the power of one man in the boat, and (contrary to Mr. Clifford's statement) perfectly independent of those who are lowering by the tackles, might probably practise this feat with impunity.

I do not consider Mr. Clifford is borne out in his statement, which attributes the fragility of some of his pendants to the neglect of any one particular dockyard; I believe never was invention more zealously and carefully worked out by our Dockyard executives. It must be borne in mind that a man-of-war has her boats in constant use, whereas emigrant and transport ships have seldom any occasion whatever to lower them; if, therefore, as Mr. Clifford states, no reports have reached their owners of broken gear, &c., the inventor has reason to rejoice, but the public at large will not receive the fact as a proof of the infallibility of his plan or the durability of his pendants.

In conclusion, I will add that the test of time is alone able to establish the merits of every plan, and in the meantime there is no reason in the world why two methods of saving life, which have already given proof of their efficiency, should not jog along amicably together, and not jostle each other like the two pitchers in the stream, in the hope of one becoming irretrievably smashed. There is surely room enough for both, and there are ships enough on the ocean with their living freights whose owners should gladly receive every invention which may tend to diminish the loss of human life.

I remain, Gentlemen, your obedient servant,

NAUTICUS.

July 2nd, 1859.

APPLICATION OF ARTIFICIAL LIGHT IN PHOTOGRAPHY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Permit me through the medium of your columns to suggest an improvement in the use of artificial light in photographic operations—a subject which appears to be attracting much attention at present.

It is well-known that when solar light is analyzed by the prism it is found that not only are the three primary colours which compose white light arranged in different proportions in different parts of the spectrum, so as to produce a great variety of colours, but that the three principles existing in the rays of the sun—light, heat, and actinism—are likewise each of them distributed unequally over the spectrum, appearing in greater intensity in some parts than others, so that each colour is combined with a definite proportion of each of the three principles. The red rays have the greatest heating power; the lightest colour is the yellow; while the blue rays are the most definite in both heating and illuminative powers, but are by far the richest in actinic or photographic power. This law prevails equally in colours obtained from sources other than the solar spectrum, and is applied practically in many of the operations of daily life. Thus in artificial illumination, we select substances which by their combustion emit a large proportion of yellow light; and when we wish to diminish to the greatest extent the apparant light of a luminous object, the sun, for example, we observe it through the medium of a blue glass. In warming or apartments we make use of coals, &c., which by their burning give a red light, the characteristic property of which is, that it contains a very great amount of radient heat, with but a comparatively small proportion of illuminative power (indeed the appearance of a red object invariably conveys to the mind a sensation of warmth). The single exception is in the selection of sources of artificial light for photographic purposes. In this case the object aimed at seems to be the production of a light of the greatest possible whiteness and intensity. But the blue rays, and especially the violet, possess the greatest proportion of the photographic principle, and are at the same time the most deficient in heating and illuminative power, while the red and yellow rays are almost entirely destitute of the photographic principle. And it is evidently this principle alone which is of service in a photographic operation, the others—the light especially—being an evil rather than otherwise if the object in view be the production of a portrait, for the inconvenience and discomfort experienced by the sitter in consequence of too great an intensity of light almost invariably occasions distortion of the features. Why, then, is not a blue or a violet light made use of? Such a light would be extremely powerful as a photographic agent, while its low illuminative and heating power would admit of its being used in a very high degree of intensity without creating discomfort to the eyes of either sitter or operator. It would doubtless be a very difficult task to discover a composition which would burn with a pure and intense violet light.

I have not had the opportunity of investigating the subject practically, and I am therefore indebted to place it before your readers in the hope that the suggestion may receive the consideration of any one who may think it worth his while to pursue the subject further. In case the idea should not be a new one, I hope that my ignorance of such a fact will prove a sufficient excuse.

My attention was first drawn to the subject by a lecture illustrative of Moule's method of obtaining photographs by artificial light, in which a light of great whiteness and intensity is produced by the combustion of a chemical composition; but I observed that the great intensity of the light

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necessitated the interposition of a screen between the light and the face of the sitter, who afterwards remarked that the light was even with this precaution very oppressive.

Your obedient servant,

FRANCIS H. BAKER.

Inland Revenue, Somerset House,
29th June, 1859

THE ARMSTRONG GUN.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—As my son, Dr. H. Drake, has considered it right to call your attention to the gun known by the name of the "Armstrong gun," I beg to request the favour of being permitted to offer a few remarks on the subject.

In your number 1779, of Saturday, September 15th, 1857, a letter appeared from me in explanation of the difficulties we had to contend with at Woolwich relative to this and a number of guns brought under discussion by official authority, before Sir William Armstrong by his own statement, to which Dr. Drake calls attention, had undertaken to propose the one in question; consequently, I will not occupy your space beyond necessity, in further explanation of those difficulties.

Having so far made public the origin of his invention, I should advise Dr. Drake to hand you for publication a drawing in detail, as it will at once show the inventions to be one and the same in every respect—*even to the forging*—with the exception of the Swedish process of preventing the escape of gas introduced in the Armstrong gun, but not so simple or effective as that previously submitted.

As my son had visited Woolwich three times at a considerable disadvantage, I did not consider it advisable to trouble him with the description of the Armstrong gun when professionally made known to me in the early part of December; at the same time I was not unmindful of my duty in claiming the originality of the invention "instanter" at the War Department and Horse Guards; and I requested Major General Peel to allow me to place before him the manuscript invention, which he declined to inspect or allow it to be inspected by any one in his confidence at the War Office.

I then proposed to place it in the hands of a committe of professional gentlemen, and named Sir Charles Fox, Mr. William Fairbairn, Mr. Thomas Howard, and Mr. James Nasmyth, or any others whom the Secretary at War might suggest, with permission to pay all expenses out of any award which those gentleman might consider due under the circumstance of Dr. Drake having officially submitted his gun to the select committee *before* Sir William Armstrong, but which was also refused; and this, it must be understood, was *before the Secretary at War had ordered it to be adopted in Her Majesty's service.*

I have the honour to be, Gentlemen,

Your obedient humble servant,

JOHN POAD DRAKE.

London, June 22nd.

THE GREAT EASTERN.

GENTLEMEN,—All those who feel anxious for the success of such a gigantic structure as this vessel presents, naturally ask the question if the best ways and means are being employed to produce such a result? As regards the propelling means, such is most certainly not the case; in the first place, the employment of paddle-wheels destroys her usefulness as a sailing vessel; which is the more to be regretted, as a ship of her size and structur might be expected to realize a speed beyond that ever obtained. Her screw is not provided with any means of raising it out of the water; so that if the engine is at fault, or any cause prevents its employment, it must be dragged onwards at a great loss of speed; if anything foul or injures it, there is not any remedy, as the difficulties of examination, without a trunk over the screw, and proper means of lifting, are necessarily increased from her size. Having two distinct propelling means, it *necessarily* offers the opportunity of using either separately, but from what has been shown, it has evidently not been made available in this case.

A READER.

LORD CARLINGFORD ON THE GRIFFITH'S SCREW.

VISCOUNT CARLINGFORD requests us to give place to the following letters, addressed originally to the editor of the *Engineer*. Our contemporary doubtless had his own sufficient reasons for rejecting them, but as these reasons do not appear to us, and as we see nothing particularly objectionable in the letters, we willingly insert them, particularly as Lord Carlingford deems their insertion of importance to his claims as an inventor.

GENTLEMEN,—As a matter of justice I must beg leave to request you will give publicity to the letter I addressed to you previous to your publication of the 10th inst.,* for I cannot submit to the insidious manner of attempting to supersede my discovery of the true principle of the screw propeller, which I presented to the country and the world, and which has caused a revolution in navigation, and has all but put down the paddle-wheels, except on rivers. The public know its value, and I will not allow any person to attempt to rob me of the honour of having discovered it without protesting against them. In your article on the subject you say, "The spherical boss, which is one of the distinctive features of the Griffith propeller," this may be the case, but it is also the case with the Carlingford screw, and to which I afterwards added a horn in continuation, to be used when required to be placed in front; so that the spherical boss is no novelty whatever, nor would the hour-glass shape of boss be either a novelty, while the contrivance to alter the pitch proves a total ignorance of the principle of the screw altogether, as described in my letter above referred to. So the mere cutting of the corners of the screw which I have done long since, and the mere increase of size of the screw towards the centre cannot constitute a right to a patent, for that does not touch in the slightest degree the real principle of the screw, which must be for ever adhered to whatever increase or alteration is given to its edge or size at any part. I cannot admit the correctness of your remark in reply to my letter, "that Mr. Griffith condemns the whole family of the feathering screws," when he claims the improvement of making the ends of his screw more feathered by clipping off the corners. The account I read in the papers distinctly states that the invention principally consists in the power of altering the pitch. Now the clipping of the corners is merely to obtain a sharper or more obtuse angle to the edges of the blades, and it is done at the sacrifice of part of the most effective part of the screw, but which can be better obtained by giving the edges the fish-bone or saw form to proceed through the water and leave it, which is without exception the principle of nature. I therefore repeat, and request as a point of justice, that you will publish my letter here referred to, as well as this one, for of course the only object for the public is to know the truth, and the entire truth. These attempts to deprive me of the honour of my discovery remind me of the fable of Florian, where the butterfly is envied for his wings, yet the clipping of the corners will not destroy them.

I remain, gentlemen,

Your obedient servant,

CARLINGFORD.

Swift's Heath, Kilkenny, June 18, 1859.

GENTLEMEN,—If you refer to my last letter you will perceive that you are mistaken in saying that I claim the invention of the spherical boss, one of so little consequence; I merely said that I adopted that form as well as I did others; many persons may have done so before me. I only stated my having given it that form to show it was no novelty, and such also appears from your statement. Then, I ask, what novelty or what improvement has Mr. Griffith made for which he proposes taking a patent? I can only see the adjustable pitch, which, as I before stated to you, proves a total ignorance of the principle of the screw. It is not possible that he means to take a patent for cutting off the corners of the Carlingford screw; but it is neither for the spherical boss, for that is only required when the part of the vessel where it is applied is not wide or large enough to cover its front centre, to prevent that part from presenting a flat surface to the water; nor is it the edges of the screw that is of so much importance, but that which is of importance, and for which I claim the discovery of the screw now universally adopted, is that of the proportion of pitch from the extremity to its centre, which I discovered should be one-sixth taken from its centre line, which you published for me, and the problem of which you submitted for me to the scientific world. All the other details are not worth noticing, being very trivial to the real discovery, which has re-established confidence in the screw-propeller, that had been totally lost up to the very time I presented my discovery to the Admiralty; but I consider this manner of giving insidious replies to my letters, instead of inserting them, to be very unfair, leaving erroneous impressions of that which I had stated; but first insert them, and then reply whatever you please. I must still insist that the principle of "The Griffith Screw," which I read the account of, was experimented principally on its different variations of pitch, first on one pitch, then on a sharper pitch, and finally to be tried on a medium pitch; this every person can see on referring to the report; but I say again publish my letters, and they will speak for themselves, they are scientific, and explain the true principle of the screw-propeller, which has done wonders, and yet is still very little understood, as seen by the account given of the late trials with "The Griffith Screw."

I remain, gentlemen,

Your obedient servant,

CARLINGFORD.

Swift's Heath; Kilkenny, 27th June, 1859.

* The letter in question states that any alteration of the pitch of the screw must destroy at once the required proportion of pitch, as of course it would be diverted at the centre as much as at the extremities; the due proportion of pitch would consequently be lost, for it should be diverted six times more at the extremities, which would be impossible to accomplish, and at the same time give firmness to the screw, and even if accomplished of no use whatever.

Proceedings of Societies.

ROYAL AGRICULTURAL OF ENGLAND.

June 29.—At a weekly council held this day, Co-Challoner, Trustee, in the chair, the names of candid dates for election were read. Dr. Voelcker submitted to the Council an analysis of a Mangel Wurzel which was grown in 1857, and has been kept for nearly two years in an apparently sound condition. A communication was read by Mr. Charles Fulbrook, of Dallington, Hurst Green, giving the result of his investigations of the laws governing the wet and dry seasons occasionally experienced in this country. On the motion of Lord Feversham, seconded by the Hon. Wm. Cavendish, this communication was referred to the Journal Committee, and the thanks of the Council were ordered to be conveyed to Mr. Fulbrook. M. Tisserand, Inspector of the Imperial Farms of France, transmitted to the Council programmes of the special international competition of reaping machines, to take place at the Imperial Farm of Fouilleuse, near St. Cloud, between July 20th and 25th next. The certificates of entry to be sent by exhibitors to his Excellency the Minister of Agriculture, 78 *bis*, Rue de Varennes, Paris, on or before July 10th. The following communications were also received from Mr. Chas. W. Hamilton: a Schedule of Queries issued by the Royal Dublin Society respecting the Condition of Farm Labourers; the Journal of the Agricultural Society of Alger, and the Journal of the Central Agricultural Society of Belgium, for all of which the thanks of the Council were ordered. Mr. H. Tucker, from the New York States Agricultural Society, presented a letter deputing him to attend on behalf of that Society at the Warwick Show. The Chairman assured Mr. Tucker that the officers of the Society would afford him every facility in their power to enable him to inspect the trials and general exhibition.

THE GEOLOGICAL SOCIETY OF LONDON.

June 22.—Sir C. Lyell, Vice-President, in the Chair. *Adjourned Meeting.*—The following communications were read:—1. "Further Observations on the Ossiferous Caves near Palermo." By. Dr. Falconer, F.R.S., V.P.G.S. 2. Mr. Prestwich gave in a few words the results of the examination of the bone-cave at Brixham in Devonshire. 3. "Observations on a Flint-implement recently discovered in a bed of Gravel at Saint-Acheul, near Amiens." By John Wickham Flower, Esq. (Communicated by Joseph Prestwich, Esq., F.G.S.) The gravel capping a slight elevation of the chalk at St. Acheul is composed of water-worn chalk-flints, and is about 10 feet thick; above it is a thin band of sand, surmounted by sandy beds (3 feet 6 in.), and brick-earth (11 feet 9 in.) In this gravel the remains of elephant, horse, and deer have been

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found, with land and fresh-water shells of recent species. From the gravel Mr. Flower dug out a flint-implement, shaped like a spear-head, at about 18 inches from the face of the pit, and 16 feet from the surface of the ground. Mr. Flower in this communication pointed out evidences to prove that this and many other similar flint-implements obtained from the same gravel were really the result of human manufacture, at a time previous to the deposition of the gravel in its present place. Mr. Flower's visit to St. Acheul was made in company with Messrs. Prestwich, Godwin-Austen, and Mylne, with a view to verify the discoveries made respecting the occurrence of flint-implements in the gravels and peat of the Somme Valley by M. Boucher de Perthies, of Amiens. [A large collection of Osseous remains and Flint-objects from the Grotto di Maceagnone, and others from San Ciro were exhibited; also specimens of Flint-objects from Brixham Cave, the gravel of Amiens, &c., and a series of Flint-implements from Arabia, North America, Mexico, &c.] The next meeting of the Society will be held November 2nd, 1859.

ROYAL GEOGRAPHICAL SOCIETY.

The closing meeting of the Session of this Society, numerously attended, was held on Monday evening at Burlington House; the Earl of Ripon, President, in the chair. *Presentations.*—S. W. Silver and Christian Hellmann, Esqs., were presented upon their election. *Elections.*—The Duke of Newcastle, the Earls of Elgin and Airlie, the Hon. Robert Marsham, Sir Hercules G. R. Robinson (Governor of Hong Kong), Major Henry Crucroft, Captain Phillip D. Margesson, R.A., George Barclay, Frederick W. Bigge, H. Austin Bruce, M.P., R. A. Osborn Dalyell (Consul at Erzerúm), George Fitzroy, William Fryer, Charles P. Grenfell, M.P., W. Vernon Harcourt, and William H. Smith, Esqs., were elected Fellows. *Proposals.*—Professor Otto Struve, of St. Petersburg, as a corresponding member; Lord Henry Scott, Sir Edward Borough, Bart., the Rev. Charles Oakley, M.A., Henry Duckworth, George Gammie, Charles Marett, M.A., and Francis Tagart, Esqs., were proposed as candidates for election. *Exhibitions.*—Several drawings and photo-lithographs illustrating the scenery and physical geography of the highest parts of the Himalayas, by the Messrs. Schlagintweit; and a mechanical and magnetic Compass, invented by Mr. Maillard, were exhibited to the meeting. *Accessions.*—Sir John Rennie's work on the "Plymouth Breakwater," presented by the author; Humboldt's "Travels," "Cosmos," and "Aspects of Nature," presented by H. G. Bohn, Esq., F.R.G.S.; Dr. Lange's map of the Mediterranean, and Stanford's library map of Australasia, were among the late accessions to the Library and Map-rooms. The papers read were:—1. Notes on a Voyage to New Guinea, by Alfred R. Wallace, Esq., F.R.G.S. 2. Remarks on Portuguese Journeys in Central Africa. By James Macqueen, Esq., F.R.G.S. After some observations from Captain Burton in reply to Mr. Macqueen, Major Palmer, F.R.G.S., read: 3. Notes on the Island of St. Helena," to accompany his new map of that island. At the suggestion of Sir Roderick Murchison, who introduced them with allusions to their travels, one of the brothers Schlaginweit offered remarks in explanation of their drawings in the Himalayas; and the President having proposed a vote of thanks to the authorities of the University of London and of the Royal Society for the use of their large hall during the past session, the meeting adjourned to November 14.

ASSOCIATION OF FOREMEN ENGINEERS.

July 2.—The usual monthly meeting of the Association of Foremen Engineers took place at their temporary rooms in the City. Mr. Joseph Newton presided over a large assemblage of members, drawn together by the announcement previously made that Mr. Stabler would read a paper on the "Economical Formation of Steam.

The business of the evening commenced with the bringing up of the auditors' report for the half-year past, and its reception by vote on the part of the associates. Four committee-men were also elected in place of those who retired by rotation, and this, with some minor matters, brought 9 o'clock—the appointed hour for lectures and paper-reading, and when the friends of members are also admitted. Mr. Newton having now called upon Mr. Stabler to proceed with his task, at once commenced it. He said, in reviewing the numerous contrivances for the cheap generation of steam which had followed the wondrous inventions of Watt and of those unrecognised great men who quietly assisted him in his study and in his workshop—that so far as the character and properties of steam were concerned, little had been discovered that was not known to Watt himself. His rules and data, to a considerable extent, were the surest guides to mechanical men of to-day. The forms of boilers, areas of fire-grate, and perfect and imperfect combustion of fuel, occupied much of Mr. Stabler's paper. His conclusions being that the "economical formation of steam" depends on perfect combustion, and the absorbing and transmitting powers of boilers. Combustion might be perfect, but the absorption of a boiler might be inferior, and then the evaporation of water would be at a low rate as compared with the consumption of fuel. To construct a boiler with rapidly-absorbing materials was one of the great principles aimed at by the engineers of our time.

Mr. Stabler spoke of the proportions necessary for boilers of marine, stationary, and locomotive engines, and ended his remarks by inviting his brother members to think out for themselves the great question of steam economy, upon which wide differences of opinion still existed.

A discussion followed, in which Messrs. Aydon, Briggs, and others joined; and after a vote of thanks to Mr. Stabler had been unanimously given, and an announcement made of Mr. Galloway's intention to read a paper at the August meeting on "The Superheating of Steam," Mr. Newton declared the meeting to be dissolved.

Our Weekly Gossip.

IT is a singular fact that in giving the return of coinage executed during the year 1858, almost all our contemporaries, from the *Times* downwards, fell into error as to the quantities of pence, halfpence, and farthings produced at the Mint. Reference to the columns of last week's MECHANICS' MAGAZINE will enable the public to correct that error. In examining the Government report on the subject, it is evident that other journals *have mistaken the number of pounds in value of copper coins struck*, for the *number of pieces* produced, a circumstance which of course makes their statistics inaccurate, to the extent of several millions of coins.

The directors of the Great Northern Railway having consented, from the 1st of July last, to allow the produce of the various South Yorkshire Collieries to be sold with the name of the colliery, and unmixed with any other coal, the owners of the best coal naturally regarded this as a very great advantage, and resolved to celebrate this separation of qualities by conveying to their collieries and back eight hundred members of the press, the London coal trade, and others, in order to afford them an opportunity of seeing the source of supply and the mode of working the coal in the pit. Of this arrangement we availed ourselves on Wednesday last, proceeding from town early in the morning, and visiting the Lund Hill, the Edmund Main, and the Oaks collieries, returning to town *via* Doncaster in the evening. The Lund Hill colliery we descended, (the depth being 630 feet) and had the very doubtful satisfaction of marching, Davy in hand, through some mile or two of passages, mainly of about three feet in height. As our pace was somewhat rapid, and as it had to be kept up while we were doubled down into the dwarfish height of, say, 40 inches, we did not find the visit particularly exhilarating. We subsequently descended the Edmund Main, however, but finding the shaft wetter than was agreeable, we declined entering upon further subterranean exploration, and allowed ourselves to be run up to the sunshine again. Another short trip next carried us to the Oaks, the splendid winding engine of which attracted all our attention; and a still further trip delivered us at Barnsley, where welcome ablutions and other creature comforts were happily procured. Here Mr. Carter, of the well-known firm of Carter, Brothers, gave us a run through their extensive linen fabric factory, in which we were so fortunate as to find in operation a loom which will make a fabric no less than five yards wide—the largest loom of the kind in the world, we believe. The shuttle seems fairly to tire in crossing it. We must not omit to state that Mr. Plimsoll, junr., of the King's Cross Station, managed the whole trip with exemplary skill and suavity, and as the merits of the South Yorkshire coal, both as a steam coal, a gas coal, and a house coal—different kinds, of course—seemed to impress many of the visitors, we doubt not he will find his anxiety and urbanity rewarded.

In his speech at the anniversary dinner of the Society of Arts, held last week, the Chairman of Council (Mr. C. Wentworth Dilke), afforded some useful information respecting the proposed Exhibition of 1861. From his remarks, it appears that the project for that Exhibition was not stopped. Circumstances over which they had no control had unhappily produced continental war; but he ventured to say that the proposed Exhibition was simply postponed. He had no hesitation in declaring that but for the war everything was prepared and success was certain. A guarantee fund to the amount of £250,000 was so far advanced that he felt certain it would have been completed immediately after the list had been made public. Therefore, whenever peace should be happily declared, he trusted that whoever might be in power in the Society—for his term of office expired on the following day—would bring forward this movement again, and that in 1862 or 1863 they would have a Universal Exhibition, which would be equally if not more successful than that of 1851.

The Emperor Napoleon is making free (and fair) use of balloons in his operations against the Austrian armies in Italy. This fact has called forth a letter from Mr. Coxwell (to whom we made reference a few weeks since*), in which he says:—"Ever since the Russian war, and, indeed, during that calamity, I have laboured single-handed in endeavouring to provoke the attention of our Government, our scientific men, and the English press to the importance of aërial observatories. As the idea just begins to engage public notice at the present moment, it may not be uninteresting to simply correct one or two erroneous notions as to the *modus operandi* with war balloons. In the *Aërostatic Magazine* for this year I devote a chapter to 'Balloons for Reconnoitring,' but as extracts may be too lengthy I will briefly observe that balloons may be used with long wire ropes attached (kite fashion) without being let go, which might endanger their falling in an enemy's camp. 2. There is no real necessity that the balloon should be within close range of large or small shot, as an angle of elevation proportioned to the distance would afford the required information. 3. Hydrogen gas, generated by the decomposition of water, would enable balloons to be inflated in whatever locality desirable. Balloons may also be made the vehicles of laying a temporary electric wire or thread in any direction required. A large revolving drum beneath the car might contain many miles of thin wire, and pay it out as desired. Certain indications would be required to mark its coarse, but this could be easily managed. In this way a network of electrical communication might be established. Like spiders the balloon could spin away in various directions, and if one part o' the web gave way the main lines might be depended upon to convey intelligence."

The following Minute has been recently passed by the Committee of Council on Education:—My Lords proceed to revise the Minutes which have been passed in the Science and Art Department for the encouragement of scientific instruction among the industrial classes of this country who have already received primary education. I. All former Minutes relating to Science or Trade Schools, and Scientific class instruction, except those referring to Navigation, Public Lectures, and the training of Teachers (as hereafter appended), are hereby cancelled, and the following regulations are substituted in their place. II. The Science and Art Department will hereafter assist the industrial classes of this country in supplying themselves with instruction in the rudiments of—1, Practical and Descriptive Geometry, with Mechanical and Machine Drawing and Building Construction; 2, Physics; 3, Chemistry; 4, Geology and Mineralogy (*applied to Mining*); 5, Natural History, by augmentation grants in aid of salary to competent Teachers, and by payments and prizes on successful results, and grants for apparatus, etc. III. Any School or Science Class either existing or about to be established and duly approved by the Science and Art Department, may apply, through its Managers, *for a Certificated Teacher*, or for the certification of any Teacher, in any one or more of the above-named branches of Science IV. Examinations for certificates of three grades of competency to teach any of the above-named Sciences will be held annually by the Department, in the last week of November, in the Metropolis, as follows:—Nos. 1, 2, and 5 at South Kensington; No. 3 at the Royal College of Chemistry, Oxford-street; No. 4 at the School of Mines, Jermyn-street. V. Annual grants, in augmentation of salaries of Teachers so certified to teach in any of the above-mentioned Sciences, will be given as follows:—For the 1st grade of competency, £20; for the 2nd grade of competency, £5; for the 3rd grade of competency, £10. Any Teacher holding a certificate of competency to give primary instruction will receive, from the Science and Art Department, a sum equal to the augmentation grant which has been attached to such certificate, in addition to the grants above-mentioned. VI. Such grants will only be made while the Teacher is giving instruction in a School or Science Class for the industrial classes, approved by the Department. VII. The Department will require that suitable premises shall be found and

* See Vol. L. (New Series), p. 352.

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maintained at the cost of the locality where the School or Class is held; that the names of ten students shall be entered whose fees for half a year shall have been paid in advance; and that the local Managers shall guarantee, for the support of the Schools and Teachers, from fees or local funds, a sum at least equal to the grants so long as they shall be paid. If at any time neither fees of pupils nor local funds cover the requisite amount, it must be inferred that there is no demand for instruction in the abovenamed Sciences in that locality, which the Government is justified in aiding; and the assistance of the Department will be withdrawn. VIII. Every School or Class having a certified teacher will be inspected and examined once a year by the Department, and Queen's prizes of an honorary kind will be awarded to successful students. IX. Payments will be made to the teacher on each first-class Queen's prize obtained by the student, £3; on each second-class, £2; and on each third-class, £1. X. A grant towards the purchase of apparatus, fittings, diagrams, etc., of 50 per cent. on the cost of them, will continue to be afforded to Schools and Classes in Mechanics' and similar Institutions.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 2674, 2686, 2693, 2708, 2711, 2717.
BOILERS AND THEIR FURNACES, 2641, 2656, 2658.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2646, 2701, 2709, 2710.
SHIPS AND BOATS, including their fittings, 2640, 2651, 2671, 2699.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines. *None.*
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2652, 2665.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2647, 2654, 2657, 2661, 2677, 2679, 2684, 2691, 2694, 2697, 2698, 2704, 2715, 2720.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 2642, 2643, 2675.
LIGHTING, HEATING, AND VENTILATING, 2659, 2662, 2669, 2673, 2680, 2692, 2705.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2642, 2676, 2678, 2683, 2687, 2703, 2718.
METALS, including apparatus for their manufacture, 2700.
CHEMISTRY AND PHOTOGRAPHY, 2644, 2649, 2667, 2682, 2706.
ELECTRICAL APPARATUS, 2670, 2714.
WARFARE, 2664, 2668.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 2645, 2648, 2650, 2653, 2655, 2660, 2663, 2666, 2667, 2672, 2677, 2678, 2681, 2682, 2685, 2688, 2689, 2690, 2693, 2694, 2695, 2696, 2702, 2707, 2709, 2712, 2713, 2715, 2716, 2719.

2640. H. JORDAN. *Improvements applicable to navigable vessels.* Dated November 20, 1858.

This comprises various novel features in the build and rig of iron and wooden ships, the details of which are too voluminous to find space in our pages. *Patent completed.*

2641. D. EVANS. *Improvements in tubular steam-boilers and fire-places or furnaces used therewith.* Dated November 20, 1858.

IN constructing a tubular steam-boiler, the patentee forms across the fire-box a horizontal or somewhat inclined water-chamber, open to the sides of the fire-box and also to the body of the boiler. Through this water-chamber numerous tubes pass, the ends of which are respectively fixed in the upper and lower plates of the chamber. The upper surface of the chamber is to receive the fuel, and the draft is caused to pass down through the fuel and down through the tubes into a chamber below, and thence the products of combustion pass through numerous horizontal, inclined, or upright tubes through the body of the boiler into the chimney. To heat water in a separate tank, or in the tender of a locomotive engine, an arrangement of hollow or tubular fire-bars is used. *Patent completed.*

2642. L. PERCIVALL and J. HOUGHTON. *Improvements in attaching knobs of glass, china, and earthenware, to the spindles of locks and latches, and to drawers and other articles.* Dated November 20, 1858.

The inventors make that part of the spindle which enters the knob of any other than a cylindrical form. A screw passed from the front of the knob engages in the end of the spindle, and fixes the knob thereon. A washer and socket may be put on to the spindle between the shoulder of the knob and the lock or latch to prevent friction of the shoulder of the knob against the door. There is also an arrangement for attaching knobs when rotary motion in the knob is not required. *Patent abandoned.*

2643. J. YOUNG. *Improvements in fastenings for window sashes and casements, and in chain used in suspending.* Dated November 20, 1858.

This consists, 1, in applying locking mechanism to window sashes, &c.; 2, in making chain for suspending window sashes, &c., of alternate cast, single links, and wrought or stamped double links, the said links being jointed together by pins. *Patent completed.*

2644. H. SWAN. *Improvements in stereoscopes and other optical instruments, and in stands or supports for stereoscopes.* Dated November 20, 1858.

In arranging steoroscopes, the standard, which connects the stage of the instrument with the frame in which the glasses are fixed, is divided transversely into two parts, and in one of these parts two projecting wires or prongs are fixed and these enter corresponding holes in the other part. The holes are lined with cloth so that sufficient friction may be offered to the sliding of the prongs in the holes to retain them in any position in which they may be placed. When the instrument is in use it is held by a button attached to the lower part of the standard, and the adjustment of the distance between the picture and the glasses is effected by placing the end of the thumb in a recess formed in the upper portion of the standard, moving it up or down till the proper distance is found. The portions of the standard may be either rigidly fixed to the stage and to the frame of the glasses, or may be attached by hinges furnished with springs similar to the springs of a pocket knife. There are other arrangements included. *Patent abandoned.*

2645. H. BODEN and T. COOPER. *Improvements in platting or braiding machinery.* Dated November 20, 1858.

Provisional protection has not been granted for this invention. *Patent abandoned.*

2646. H. GARDINER. *Improvements in the compound axle hub and wheel for railroad cars.* Dated Nov. 20, 1858.

This consists, 1, in having the joints of the compound axle within the hub and within the line of pressure upon the wheel, and in constructing and arranging the parts constituting the hub in connection with a cylindrical sleeve or case (also within the hub) over the joint, so as to hold the parts together with sufficient strength, and so as to permit the wheels to turn independently of each other and of the main part of the axle, and for the most part to permit the two wheels and the whole compound axle to make their rotation together. 2. In constructing the hub and combining the parts of the hub and the plates so that the wheel plates are set into a mortice between the rings constituting the sections of the hub, while the exterior or edges of the wheel plates are upset so as to secure and hold the tyre very firmly. 3. In adapting a wheel constructed of a solid hub to the compound axle with the joint within the hub. *Patent completed.*

2647. C. H. MELLOR. *An improved manufacture of woven fabrics.* Dated November 22, 1858.

This consists in combining honeycomb weaving with plain, twilled, fancy, or double weaving. *Patent abandoned.*

2648. R. NELSON. *Improvements in apparatus for raising and lifting water and other liquids.* Dated November 22, 1858.

Here the patentee obtains a vacuum by the ignition of heated hydro-carbon fluids, such as turpentine, naptha, and alcohol. The invention is not described apart from the drawings. *Patent completed.*

2649. F. A. THEROULDE. *Improvements in obtaining salts and products from the ashes of marine plants.* Dated November 22, 1858.

Here a concentrated solution is prepared from the ashes by causing successive quantities of water to pass through successive layers of ash. *Patent completed.*

2650. S. W. JOHNSON and J. VARLEY. *Improvements in pressure and vacuum gauges.* Dated November 22, 1858.

This invention was described and illustrated at page 74 of the MECHANICS' MAGAZINE. (New Series.) *Patent completed.*

2651. A. V. NEWTON. *Improved apparatus for propelling and steering vessels.* (A communication.) Dated November 22, 1858.

The object here is to effect the steering of the vessel by the propeller itself, the axis of which is made moveable for the purpose. *Patent completed.*

2652. E. H. BENTALL. *An improvement in the construction of turnip-cutters.* Dated November 22, 1858.

This relates to a method of discharging the dirt and the chips made in turnip-cutters so that they may be collected separately from the other and clean portions of the cut root or turnip. The invention applies chiefly to the gardener or barrel turnip-cutter, and consists in providing it with an additional spout or discharge to receive and convey away those portions of the root that do not pass through the knives, and find their way into the barrel, but lie outside the barrel until they are discharged. *Patent completed.*

2653. T SPENCER. *Improvements in the manufacture or construction of springs.* Dated November 22, 1858.

This relates, 1, to "Baillies" volute springs, and consists in forming the coils with ribs or projections upon them for strengthening the coils and preventing them from pressing or rubbing their whole surface upon each other when the spring is being compressed. It relates, 2, to laminated springs, and consists in dispensing with the slits and studs, or ribs, by forming at the ends of the plates small hollow ribs or projections, the underside, or cavity, formed in making these ribs upon the upper plates fitting upon the ribs or projections upon the under plates or *vice versâ*. *Patent completed.*

2654. W. RALSTON. *Improvements in embossing and finishing woven fabrics, and in the machinery or apparatus employed therein.* Dated November 23, 1858.

The patentee employs a roller of wood or metal, and grooves or indents upon it any desired design, and causes it to revolve with a bowl or bowls of paper, &c. He gives the circumference of the pattern roller a quicker motion than the circumference of one of the bowls, so as to obtain a frictional action upon the surface of the fabric as well as pressure, so that if the fabric is moved transversely when fed to the machine, an indefinite number of watering patterns may be given to the fabric at one operation or passage; but if two operations be given, moire antique or other varieties may be obtained, which can be still further varied as desired, according to the number of times the fabric is allowed to pass through the machine. A bright finish or lustre is given to the fabric by the rubbing action of the two surfaces of the roller and bowl. *Patent completed.*

2655. W. H. DAWES. *An improvement in forge hammers, and in the anvils used with forge hammers and squeezers.* Dated Nov. 23, 1858.

Here the patentee makes a series of channels or passages in the tools of the said hammers and anvils, the chambers, &c., being made in a plane parallel to that of the working surface, and as near the surface as possible. By causing water to circulate through the channels, &c., the forge hammer and anvils are kept cool. *Patent completed.*

2656. W. GORMAN. *Improvements in furnaces and in the combustion of fuel, and in apparatus connected therewith.* Dated Nov. 23, 1858.

This relates to a process of burning gaseous fuel in draught furnaces, such as are usually employed for generating steam in steam boilers, and consists in preventing air from getting up through the incandescent or highly-heated coke lying on the grate bars when a fresh charge of coal is laid on, and while the gaseous or more volatile part of the coal is being evolved. The stopping or limiting of the access of air to the coke undergoing combustion prevents the production of carbonic acid gas which ordinarily mingles with and prevents or injures the combustion of those gases which are being evolved from the superincumbent fresh charge of fuel. The furnace is thus converted into a kind of gas retort, and it is only necessary to supply sufficient air for the combustion of the gases arising from the newly-laid-on coals by the heat of the coke. Air may be admitted above the fire at the door, bridges, or sides of the furnace to assist in the combustion of the gases. *Patent completed.*

2657. J. FAIRWEATHER. *Improvements in weaving bags, sacks, and other tubular fabrics.* Dated Nov. 23, 1858.

This refers to bags or sacks for guano, grain, coals, &c., which are mostly made of "jute," or a combination of jute with tow or flax, and frequently with coloured stripes or cotton selvages. The inventor proposes, 1, to employ two sets of warps, and to weave the fabrics double, and either with or without a cord or cords or band of any kind being woven in the cloth at that part of it where the seam usually exists. These cords or bands will give strength and shape to the bag or sack, and they may be formed with loops for hanging or lifting the sack when full; or the cords may be used for tying the mouth of the sack. 2. He proposes to weave one, two, three or more sacks at the same time by weaving a strip or strips of united cloth (that is, weaving the two warps together) between each sack and cutting it after it is woven. *Patent abandoned.*

2658. N. F. BOREIKO DE CHODZKO. *A smoke-preventing apparatus.* Dated Nov. 23, 1858.

This relates to an arrangement of coking apparatus to be applied to the upper portion of the front end or mouth of a steam boiler or other furnace of a similar construction, whereby the fresh charge of green fuel is freed from its smoke and combustible gases and coked before being introduced into the body of the furnace. The apparatus consists of a closed chamber placed at the upper part of the front of the furnace, fitted with feeding doors, and supplied with one or more reversing grates upon which the green fuel is deposited. These grates turn upon centres, and are each provided with a hollow shaft which constitutes the turning axis of the grate. To facilitate the turning or reversing of the grates a handle is fitted on to the front end of each hollow axis. The object of making the axis hollow is to enable a supply of air to enter through such axis into the furnace immediately behind the coking compartment, at which point a deflecting plate is fitted for deflecting such air with the smoke and gases from the green fuel down on to the incandescent fuel in the body of the furnace. The charge having been coked, the grates are reversed, whereupon it falls into the dead plate and is pushed forward into the furnace. *Patent abandoned.*

2659. A. V. NEWTON. *Improvements in retorts for generating illuminating gas.* (A communication.) Dated Nov. 23, 1858.

This relates to a novel construction of upright retort, which presents a very large internal heated surface, so arranged as to cause the fluid substance from which the gas is to be generated to be received on a portion of the surface of the retort that is but moderately heated, and to be conveyed gradually from the coolest to the hottest part of the retort, thereby preventing the distillation of the gas-making material into volatile oil, and preventing in a great degree its carbonization on the surface of the retort. The retort is fitted with a helical or screw-like column, having a central tube in which are lateral openings between the threads of the column. A case or cover fits closely to and around the surfaces of these threads, and combines with the column to make a helical passage. The column is supported upon feet which rest on the bottom of the retort, and the case or cover has an opening or openings between it and the bottom of the retort. In the cover of the retort an opening is made and fitted with a lid, which is sealed or luted with fusible alloy, but which can be taken off to admit air to the retort, to burn out any residuary matters which may be deposited on the interior surfaces of the retort in the gas-making process, thereby obviating the necessity of removing the entire head or cover of the retort. *Patent abandoned.*

2660. A. V. NEWTON. *Improved machinery for sweeping floors.* Dated November 23, 1858.

This invention consists in hanging a revolving brush at or near one of its journals in a bridle, and attaching the opposite end of the same bridle at such a point on the case of the machine between the centre of the driving wheel and the other journal of the brush as to make the machine self-adjusting, that is, so that the driving power applied to the wheel shall exceed under all circumstances the friction of the whole brush on the carpet over which it may be traversed, thereby enabling the machine to sweep as lightly or as heavily as may be desired; the peculiarity of this ar-

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rangement being that whatever friction is received by the brush is a little more than equalled by the power applied to the driving wheel. *Patent completed.*

2661. W. WARNE, J. A. JAQUES, and J. A. FANSHAWE. *An improved fabric applicable for covering floors and walls and for other analogous purposes.* Dated Nov. 23, 1858.

This consists in the combination of a textile fabric with a compound of india-rubber or gutta-percha, mixed with ground cork and other vegetable substances, such as sawdust, woody fibre, paper cuttings, or pulp, to which is to be added sulphur, sulphate of lime, sulphate of zinc, or some equivalent compound combining sulphur. *Patent completed.*

2662. R. H. HUGHES. *Improvements in means or apparatus employed when lighting by gas.* Dated November 24, 1858.

This consists, 1, in the prevention of accident from the escape of gas through the hydraulic or such like joints of gas-burners by adapting thereto a whistle, &c., to indicate such escape. 2. In the application of spring or elastic cushions to sliding or hydraulic connections of gas-fittings to check momentum when too rapid motion has been given to the parts in sliding them. 3. In the application of hinge-pieces to the underside of pendant-burners for supporting the glass. 4. In forming globular or other formed glasses, capable for the most part of enclosing the light, with a turned-over edge or projection at the upper part, adapted to receive hooked supports. *Patent completed.*

2663. R. A. BROOMAN. *An improvement in cigar cases.* (A communication.) Dated November 24, 1858.

This consists in connecting two recesses or corrugated plates at the sides only to the inside of a case or pocket made of leather or flexible material and back to back, so that the cigars may lie in the corrugations or recesses in the plates and between them and the case. *Patent completed.*

2664. Sir C. SHAW. *Improvements in the construction of ball and bullet-proof shields or mantlets.* Dated November 24, 1858.

This consists in constructing mantlets or shields of alternate layers of wire netting or gauze, or metal cloth, or metal rods or bars worked and tied together, and hair, leather, cotton waste, tow, or other fibrous material. *Patent abandoned.*

2665. W. E. NEWTON. *Improvements in mills for grinding corn.* (A communication.) Dated November 24, 1858.

Here there are, as usual, two stones, the upper one of which is stationary, and the lower one moveable. The lower stone or runner is surrounded by a case fixed upon a cross-piece, which is attached to the fixed framing. A cast-iron arched piece of framework carries a bearing which supports the spindle of the runner. The fixed stone rests upon the edges of the case of the runner, and three small adjustable pins are adapted thereto, so that the stone may be adjusted with nicety. The upper part of the case is closed, and made air-tight by a band of wood turned and cut to fit. The runner is driven by a band passed round a large pulley on its vertical spindle, and which spindle rests on the end of an adjusting screw, by turning which, by suitable gearing, the vertical adjustment of the runner is effected. The invention also consists in facilitating the grinding and cooling of the meal by driving in air by means of a fan blower between the two surfaces where the grain is under operation. To cool and purify the air it is drawn through a wet sponge suitably placed. *Patent abandoned.*

2666. A. V. NEWTON. *Improved machinery for making bolts and rivets.* (A communication.) Dated November 24, 1858.

Here the dies and headers are combined in a rotary stock, so that they are all accessible for inspection and replacement whether at rest or in motion. The dies are fixed, the one half in clamps hinged to the periphery of the stock, and the other half let into the stock while the headers (one for each pair of dies) work in sockets in the rear of the dies, and parallel with the axis of rotation of the stock. Combined with the stock is a feed-rest and cutter, of such form as to facilitate in the feeding of the rod to form the bolts, and to effect the severance of the rod by the rotation of the stock to form the blanks without expanding the rod at the point severed; and afford support to the point of the bolt or rivet during the process of heading. For releasing the formed bolt or rivet from the dies the hinged clamps are tripped up by a projection on the rear end coming against fixed bowles, and the dies are thus opened. Sliding rods in the dies are then thrust forward by springs, and the formed bolt is ejected from one or other division of the die. The dies are further constructed so that a distinct part forming the shoulder, against which the head of the bolt or rivet will be made, may be easily removed and replaced, and a lip at their outer ends is provided which will not only facilitate the severing of the blank, but leave the end of the formed bolt or rivet slightly pointed. *Patent completed.*

2667. R. H. HESS. *A new manufacture of articles, parts of articles, parts of machinery, surfaces, and ornamental works from talc, and other silicates of magnesia.* Dated November 24, 1858.

The patentee takes certain silicates of magnesia, such as talc, teatite, &c., which he reduces to a state of powder, and presses the material into moulds of the shape of the article to be produced, adding colouring matter when required for black, or various colours, or for staining to imitate marbles, agates, or other substances. *Patent completed.*

2668. C. PETERSON. *Improvements in the manufacture of paper cartridges, and in paper applicable for waterproof purposes.* Dated November 24, 1858.

The inventor introduces a solution of soap into paper pulp, after which he introduces alum in solution, which combines with and decomposes the soap, and forms an insoluble substance which extends throughout the body of the paper or cartridge cases when made, and renders them waterproof. *Patent completed.*

2669. J. S. NIBBS. *Improvements in lighting, heating, and ventilating.* Dated November 24, 1858.

This relates, 1, to a mode of admitting air to the flame of oil or spirit lamps by perforated plates inclined from the perpendicular, and in connection with other perforated plates, whereby the air is divided into small streams, and its force upon the flame considerably checked, at the same time preventing the atmospheric air from coming in immediate contact with the wick of the lamp. 2. To a ventilating top applicable to ship, railway, and other lamps or lanterns, and gas stoves, by which the forcible ingress of air is checked, at the same time allowing a free egress to the vitiated air, &c. *Patent completed.*

2670. J. H. JOHNSON. *Improvements in the employment of electricity as a motive power.* (A communication.) Dated November 24, 1858.

This consists in the use of a number of permanent magnets so disposed that no two similar poles shall face each other. Between these magnets are fitted to play freely a number of soft iron electro-magnets, which will alternately be attracted and repulsed by the permanent magnets by reversing their polarity. The electro-magnets may be made to transmit their motions by any convenient arrangement of mechanism, when a simple electro-magnetic motion will be obtained. There are modifications included. *Patent abandoned.*

2671. C. E. AMOS. *Improved apparatus for raising and supporting ships or vessels while undergoing repair, which apparatus is also applicable for facilitating the passage of ships or vessels over bars, sandbanks, or in shallow waters.* Dated November 25, 1858.

This apparatus is composed of a number of tanks secured together, and being filled with water are sunk under the vessel; then by pumping air into these tanks the water is forced out, the tanks become buoyant and the ship is raised. The invention may be variously modified. *Patent abandoned.*

2672. F. C. CALVERT and C. LOWE. *Improvements in the manufacture of size.* Dated November 25, 1858.

This consists in the application of caustic alkalies for dissolving the gluten or protein matter contained in flour and amylaceous substances used in the manufacture of size. *Patent completed.*

2673. H. EASTWOOD. *Improvements in purifying gas for illuminating purposes.* Dated November 25, 1858.

This consists in forcing gas through or in close contact with either common spirits of wine or vegetable or mineral naphtha, or a combination of these liquids. *Patent abandoned.*

2674. R. BODMER. *Improvements in valves for regulating the supply of steam.* (A communication.) Dated November 25, 1858.

This is chiefly applicable to those valves which are intended to regulate the admission of steam to drying cylinders, where the object is to keep the steam in the drying cylinders as much as possible at a uniform pressure. This is effected by causing the steam in the drying cylinders and that supplied from the boiler to press in opposite directions upon pistons of proportional areas working in cylinders, so that a preponderance of pressure in the drying cylinders will cause the smaller piston to move in one direction, and thereby close the orifice or valve through which the steam is supplied from the boiler, whilst a preponderance in the opposite direction will cause the piston to move accordingly, and to open the said orifice. *Patent completed.*

2675. J. LUIS. *A safeguard against burglars.* (A communication.) Dated November 25, 1858.

The principle on which this invention rests is electro-magnetism. It is by the interruption of the electric current that an alarm of particular mechanism gives a signal—that is to say, at all the places and objects, &c., that are confided to the safeguard of the apparatus, the conductors are interrupted for the time when the places are no longer in a condition of safety, and where the conductors are united in a different manner when it is desired that the places should be inaccessible. By this arrangement, as soon as a hand touches a door or window, or makes any attempt to open it, the electric current is broken instantaneously, and the alarm bell commences ringing. *Patent completed.*

2676. C. F. VASSEROT. *An improved petticoat and bustle.* (A communication.) Dated November 25, 1858.

This consists in forming a frame in the shape of a fan, the articulations or ribs of which are made of steel bands suitably covered; the upper part of these ribs is bent in the shape of a spring-tong ending with a straight band, likewise covered, the end of which reaches the bottom of the petticoat. The upper part of the tongs is fastened at the waist by a moveable loop tied to the steel band so as to allow it to be lengthened or shortened at will. The open part of the frame is placed in front, and fastens with buttons. The bustle, which forms part of the frame, is fixed underneath the ribs; it is composed of two circles of different sizes kept together at a suitable distance by steel bands. *Patent abandoned.*

2677. J. NUTTALL, G. RIDING, and W. COULTHURST. *Improvement in sizes for sizing cotton, linen, or other warps or yarns for weaving.* Dated November 25, 1858.

This composition is composed of china clay one hundred pounds, or Spanish white one hundred pounds, together with muriate of soda or common salt fifty-six pounds, alum fifty-six pounds, or nitrate of soda six pounds, and farina twenty pounds (if about twenty pounds of flour be also used therewith) or farina forty pounds if flour is not desired to be used. *Patent abandoned.*

2678. F. H. MABERLY. *Improvements in candlesticks.* Dated November 25, 1858.

This invention is not described apart from the drawings. *atent completed.*

2679. C. PARKER. *Improvements in looms for weaving.* Dated November 25, 1858.

This relates to the taking-up motion, and consists in the use of plain rollers, which may be covered with woollen cloth or other elastic substances operating by a combination of tension and frictional contact upon the woven cloth so as to take it up uniformly as it is produced by the weaving action. This roller arrangement is disposed in the loom at the front or usual place of the take-up, it being preferred to use a series of three rollers acting in concert. These rollers are carried by their spindles in end bearings in the loom framings, and they are placed one above the other, but so that a line drawn transversely through their centres will form a considerable angle with the vertical line, say an angle of 45 degrees. As the woven cloth leaves the breast beam it passes down beneath the lowest roller of the series and round it, and then between the upper part of that roller and the lower part of the second roller. From this part it passes round or over the top of the intermediate roller, and thence between it and the top roller round which it is wound. The gearing of the take-up motion may be of any convenient kind, the motion from it being communicated to the bottom roller of the series, which roller again is geared by spur pinions with the second roller. The third or top roller runs loose, and is driven simply by frictional contact with the intermediate roller. *Patent completed.*

2680. F. LOOS. *Improvements in gas regulators.* Dated November 25, 1858.

This consists, 1, in placing the valves in gas-regulators in an angular position, so as to maintain an equilibrium. 2. In making the spindle hollow so that it may serve as a lubricator. 3. In making the larger sized regulators in two or more separate parts, the annular groove for the reception of the mercury being attached to the chamber by screws or otherwise. 4. In a lever hinge joint for steadying the disc. 5. In making an outlet for the gas through a spindle attached to the flouting or regulating chamber, which chamber is immersed in an annular cup containing mercury or other suitable fluid. *Patent completed.*

2681. C. MATHER. *An improved steam trap or apparatus for allowing the escape of water and air from pipes, vessels, or chambers heated by steam.* Dated November 25, 1858.

The patentee affixes to the end of a pipe a valve which, when the pipe is heated by steam, is kept closed by a weighted lever carried by a standard mounted on the pipe; but, if any water accumulates in the pipe, the decrease in the temperature contracts the pipe, and causes a short arm on the weighted lever to come against an adjustable stop, whereby the weighted lever is raised and the water allowed to escape; but as soon as steam passes through the pipe, the pipe again expands and moves the short arm of the weighted lever away from the stop, and allows the lever to close the valve. The valve also allows air to escape when steam is first admitted into the pipe, vessels, or chambers after that they have been allowed to cool. This valve also acts as a safety-valve, so that steam may escape if it is at a greater pressure than is desired in the steam-pipes. *Patent completed.*

2682. W. BURTON. *Improvements in preparing colouring matter for dyeing.* Dated November 25, 1858.

The inventor takes a preparation of orchid, which he dries and reduces to powder, and then boils or heats with naphtha: afterwards he separates it by filtration, and dries it. When this substance is used in dyeing, oxalic or other acid is used with it; or, in place of this process, the preparation of orchid is treated with alcohol, ether, or chloroform, which dissolves the colouring matter, and the dye-bath is prepared from the extract thus obtained. *Patent abandoned.*

2683. J. LUIS. *A new sort of drawers or trousers for ladies or children.* (A communication.) Dated November 26, 1858.

The patentee claims the application of springs or any other arrangement for retaining or giving form to the drawers or trousers. *Patent completed.*

2684. J. HARRISON. *Improvements in rollers applicable to sizing, dressing, calendering, and squeezing machines.* Dated November 26, 1858.

This consists in making these rollers of slate, marble, or stone. *Patent abandoned.*

2685. E. DIXON and F. FISHER. *An improvement in the manufacture of welded iron tubes.* Dated November 26, 1858.

This consists in the use of two draw-benches. The inventors place a second draw-bench near, and by preference parallel to the one situated opposite to the mouth of the furnace. After the partially-made tube has been drawn through one draw-bench, so as to effect the welding of the joint of the said tube, they transfer it to the second draw-bench, by the operation of which the final drawing and completion of the tube is effected. *Patent completed.*

2686. A. BOWIE. *Improvements in governors for marine engines.* Dated November 26, 1858.

The improved apparatus, which is more particularly applicable to screw steamers, consists, under one modification, of a weighted lever, combined with a valve on the pipe conveying steam to the engines. The weighted lever is hung so that its tendency to hang plumb, or with its centre of gravity in its lowest attainable position, shall cause the valve to close, to a greater or less extent, when the vessel becomes inclined longitudinally with her stem elevated; and this action, by reducing or cutting off the supply of steam, will have the effect of preventing the engines from running away. It is preferred to make the valve of the equilibrium class, or so as to be actuated with as little force as possible, and the weighted lever may be jointed to enable the weight to swing freely in a transverse direction without acting on the valve. The invention is susceptible of being applied to vessels propelled by paddle-wheels. *Patent abandoned.*

2687. M. MEYERS. *Improvements in parasols.* Dated November 26, 1858.

The inventor covers the ordinary parasol frame with a cover of two pieces or two outside covers of different dimensions: the same to be lined with cotton, linen, alpaca, &c. The rims of the lining and covers are formed into falls or flounces, having their edges pinked or cut into fancy patterns. The parasol is also furnished with an ornamental bow. *Patent completed.*

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2688. M. A. F. MENNONS. *An improved manufacture of leather.* (A communication). Dated Nov. 26, 1858.

The object here is the production of a semi-transparent leather susceptible of many of the applications of ivory, bone, whalebone, and analogous materials. The raw hides are soaked in a solution of lime to remove the hair, &c., and are afterwards submitted to intense pressure. *Patent abandoned.*

2689. G. RICHARDSON. *Improvements in machinery or apparatus for pressing bales of goods.* (A communication.) Dated Nov. 26, 1858.

Here it is proposed to arrange any required number of presses below the roadway of a railway siding. These presses consist of rams or pistons working in chambers of stone or wood and fitted each with a piston rod, the top of which carries an anti-friction roller, and projects, say feet above the level of the rails in the centre of the roadway. The chambers are fitted with side doors, and suitable fastenings for the facility of introducing the goods and removing the compressed bales, and the top and bottom pressing surfaces are grooved to admit of bands being placed around the bales. The pistons of the presses are forced down by the travelling over them and along the line of a loaded truck having a bar or beam attached beneath it longitudinally in an inclined position, the highest end going first. As the truck passes along, the inclined bar passes over the several piston rods and depresses them. The pistons when compressed are held down by self-acting catches, which, when released by hand, allow the pistons to rise again by the action of counter-weights. *Patent abandoned.*

2690. T. B. HUBBELL and G. J. ROLLASON. *Improved apparatus for brightening and polishing metal surfaces.* Dated November 26, 1858.

This consists in forming polishing apparatuses by uniting several discs of leather, felt, &c., by sewing them together by one or more rows of stitches, the outer row being some distance from the periphery of the discs, so as to leave the outer edges of the discs open that they may hold between them the polishing powder. *Patent abandoned.*

2691. J. B. BOOTH. *Improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton and other fibrous materials.* Dated Nov. 26, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2692. W. RICHARDS. *Improvements in the construction of gas-meters.* Dated November 26, 1858.

This consists in constructing the measuring wheel or drum with chambers having a diminished capacity near the axle. The patentee attains this end by forming the wheel with sides inclining inwards towards the axle instead of making the sides parallel to each other; thus the great variation in the measuring capacity of the chambers at present experienced by the alteration of water line will be reduced to an inconsiderable amount. When using this construction of drum-wheel the part called the hollow cover can be made flat or concave (the conical space at the inlet side of the wheel allowing sufficient space for the insertion of the spout) and thus a broader drum than heretofore can be mounted in a given size of case. In addition to contracting the measuring chambers laterally near the axis of the drum he proposes to place the cross partitions which divide the wheel or drum into chambers at a much greater angle to the axis than heretofore, in order that the resistance to the water may be as uniform as possible, and he so arranges the inlet and outlet passages of each measuring chamber that the bulk of water entering by the inlet to displace the gas shall be as nearly as possible equal to that of gas replacing the water in the outlet. It further proposes to place a plumb valve at the back of the meter (the opposite side to that at which the float is situated), which will serve to prevent surreptitious abstraction of gas by the meter being tilted forward. *Patent completed.*

2693. P. GRIFFITHS and J. BRENNAND. *Improvements in lubricators for introducing lubricating matter into steam cylinders and other chambers or parts under pressure.* Dated November 26, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2694. J. SPRATT. *Improvements in the manufacture and strengthening of paper.* Dated November 27, 1858.

This consists in combining yarn or threads with paper pulp while in the form of a sheet as it is formed in the paper-making machine for adding strength to the paper. In course paper wire is applied. *Patent abandoned.*

2695. J. TANGYE. *An improvement in hydraulic presses.* Dated November 27, 1858.

This consists in making the cistern in the base of the press, the said base being hollow. The invention is not described apart from the drawings. *Patent completed.*

2696. J. RAMSBOTTOM. *Improvements in machinery or apparatus applicable to water metres, and to indicating and regulating the flow and pressure of fluids generally, and in obtaining motive power from the same.* Dated Nov. 27, 1858.

This consists, 1, in constructing the valve and water ways so that whether the valve be flat, or plug shaped, relatively to each other the supply and exit ways shall be open whilst the valve shall traverse over one-third more space than was accomplished in the former mode of construction. 2. In constructing the valve in a slightly different manner, and in using it inverted as a seating, upon which a boss shall rotate containing a cavity of suitable size into which the fluid shall pass during a certain portion of the revolution, and out of which it shall escape for use during another portion of the revolution. The boss must be suitably ground upon the seating, and carry a wheel worked by a worm or pinion situated at right angles, such worm or pinion to be actuated by any motion, and the arrangement thus made available for lubrication. 3. In an improved arrangement if actuating valves by the expansive force of a series of two or more metals which are acted upon differently by the same temperature. *Patent completed.*

2697. G. COLLIER. *Improvements in means or apparatus employed in weaving.* Dated November 27, 1858.

The object here is the obtaining of an elastic beat up to the batten or lay, capable of being varied in power or degree. The links or arms which usually connect the lay or batten to the crank or other means employed to govern the extent of motion to the batten, in this case connect the cranks, or equivalent to a separate arm or arms rising from or near to the axis of the lay swords, so that the batten or lay may, except when otherwise controlled, be capable of considerable vibration, and the connection of the batten or lay with the separate arm or arms, so as to cause them to move together for the time required, is effected by a lever or levers with catch or catches operated by cams or tappets in such manner that the batten and separate arm or arms moved together for a time, and then by the batten being released, an elastic beat is obtained, varying in power or degree with the time when, in the rotation of the crank shaft, the batten becoming released. The separate arm or arms may be connected with or without hinge joint, and a spring or springs may be employed to aid the motion of the batten in beating up. Also the invention relates to effecting the motion to beat up by a spring or springs, and in giving motion to the batten or lay in the direction from the cloth by means of cams or tappets acting upon links or connections from the batten or lay, the links or connections being attached to the batten or lay at or near where the links are usually connected when using the ordinary crank motion. The invention further relates to preventing the fabric from creasing as it is taken by the work roller, by stretching the fabric breadthwise by means of rollers with roughened surfaces, or with the peripheries provided with teeth. *Patent abandoned.*

2698. R. ALEXANDER. *Improvements in treating, preparing, and bleaching textile fabrics and other materials.* Dated November 27, 1858.

Here the fabrics are passed in an open sheet form slowly through steam chests, instead of being subjected to the boiling process. *Patent completed.*

2699. F. C. KINNEAR and D. POSENER. *Improvements in the means of preserving life and property in navigation.* Dated November 27, 1858.

This consists in the attachment of inflated air-tight tubes or bags to the internal or external sides of ships, &c. The material preferred for making the tubes or bags is that known as double texture or Mackintosh cloth. *Patent abandoned.*

2700. H. L. PATTINSON. *Improvements in utilising the heat of slags of iron and other works.* Dated November 27, 1858.

This consists in employing by the aid of suitable apparatus the waste heat of slags of iron in the heating of arciform and other fluids. The apparatus may be varied, but it is preferred that the hot slags should be caused to move through suitable channels, whilst the air or other fluid is contained in other contiguous channels, and by preference caused to move in an opposite direction to that in which the slags move. *Patent completed.*

2701. C. BURRELL. *Improvements in traction engines and carriages.* Dated November 27, 1858.

In constructing the wheels which run on the portable railways trough or double angle iron is used, so that there are two rows of iron spokes to each wheel, the outer ends of which are fixed to the trough iron or double angle iron ring, and there are openings or spaces through the trough or double angle iron for the passage between the two rows of spokes of the A formed bars or projections which connect the shoes constituting the portable railway with the wheel, the shoes being each formed with two parallel rails on their upper surfaces on which the tyre of the wheel runs, the A formed bar or projection being fixed to the shoe between such parallel rails and the guide irons, for such projections are fixed to the trough or double angle iron so as to come on each side of the projections. In gearing the main or driving shaft with the driving wheels pinions are affixed (one at each end of the driving shaft) which when in action gear into the cog wheels on the driving wheels of the carriage, and the boiler and engines are so carried by the axle of the driving wheels that they may be raised or lowered thereon by screws and levers, by which means both or either of the pinions on the main driving shaft may be put in gear with the cog wheels of the driving wheels of the carriage, or both the pinions may be out of gear with these cog wheels according as the end of the boiler is raised or lowered in respect to the main or driving shaft. *Patent completed.*

2702. G. B. SANDER. *Improvements in jugs.* Dated November 27, 1858.

This consists in applying to the covers of jugs a moveable stop to prevent the cover rising further than is requisite to allow the liquid to be poured out, but which can be turned out of the way to allow of the cover being fully opened to fill or clean the jug. *Patent completed.*

2703. W. TILLIE. *An improvement in the manufacture of shirts and shirt fronts.* Dated November 27, 1858.

This consists in printing linen, &c., so that material for the whole front part of a shirt, together with wristbands and collars may be furnished by one breadth of cloth, the front being without folds, but printed with any suitable pattern, and the collar and wristbands being likewise ornamented. *Patent abandoned.*

2704. S. DIGGLE. *Improvements in pattern chains or other such apparatus used in weaving.* Dated Nov. 27, 1858.

This relates to the pattern chains or other such apparatus used for shifting the position of the shuttles in what are commonly called "rising box looms," and also to other pattern chains or similar apparatus used in fancy weaving for shedding the warp, &c. The invention is not described apart from the drawings. *Patent completed.*

2705. H. GERNER. *Improvements in the mode of and apparatus for manufacturing gas for illumination and heating.* Dated November 27, 1858.

The inventor mounts by preference a vertical retort in a furnace and fits the retort with one or more pipes for conducting thereto the material to be converted into gas. When making illuminating gas he uses a retort fitted with a pipe for supplying the liquid hydro-carbon to be converted into rich carburetted hydrogen gas, and also a second pipe for supplying water which is intended to yield pure hydrogen. These pipes each terminate in a pierced coil, and the coils are surmounted with scrap iron, &c., which fills the retort about two-thirds full. Pressure being put upon the fluids by the elevation of the water and hydro-carbon tanks a continuous supply is afforded to the retort. These fluids flowing down their respective pipes and circulating round the coil find an exit through the perforations in the coils in the form of fine streams of vapour, which on coming in contact with the red hot scrap iron in the retort become converted into gas. The hydrogen gas obtained by the separation of the water into its elements is generated at the hottest part of the retort and travelling upwards it meets with the hydro-carbon gas, and mingling therewith takes up and chemically combines with the excess of carbon that would otherwise be deposited in the retort. The combined gases then pass off by a syphon pipe into a purifying vessel where they are cooled and made fit for burning. When manufacturing gas for heating purposes he dispenses with the use of the liquid hydro-carbon and the apparatus employed in supplying it to the retort and obtains the gas solely by the decomposition of water into its elements. *Patent abandoned.*

2706. L. A. POSSOZ. *Manufacturing alkalies, and obtaining simultaneously other chemical products.* Dated November 29, 1858.

This consists principally in certain processes in which soda or potash is employed in the state of chlorides, sulphates, silicates, crude salts or other alkaline combinations. The salts being brought into the state of caustic potash or soda, the alkali is heated with organic substances azoted or not, and if azoted he obtains from them ammonia, but in any case he obtains oxalates, acetates, corbonates of potash or soda, which has not been hitherto accomplished. In this manufacture he does not use again the acetates and carbonates first used by submitting them each time to a new process of causticationto render them useful again, but he takes each time the caustic alkalie which he wants from the low priced salts, and obtains by his process acetates and carbonates either by purifying them ready for sale in a commercial form, or using them to produce cyanures or other chemical products. *Patent completed.*

2707. G. OATES. *Improvements in the manufacture of scissors.* (A communication.) Dated November 29, 1858.

This relates to the introduction of dies in the process of scissors making by which a uniform configuration of the sides or bows may be obtained, and elaborate ornamentation impressed upon them at a relatively small cost. The invention is not described apart from the drawings. *Patent completed.*

2708. M. STARBUCK. *A static pressure engine.* Dated November 29, 1858.

This consists in the application of a static pressure to produce a continuous movement from which the static pressure (minus the friction of the engine) can be continually given off for moving any machinery to which the engine may be applied. *Patent abandoned.*

2709. F. S. PERRARE-MICHAL. *Improvements in the manufacture of bridles (without bits and without curb-chains) for riding, driving, or otherwise conducting horses.* Dated November 29, 1858.

This bridle is constructed as follows:—The head stall is the same as those now in use, except the part called the nose-band, which has on the inside a small piece of steel, &c.; it is placed in the centre so as to press on the nose of the animal, the pressure being obtained by the connection it has with the apparatus intended to replace the bit, and by which the animal is guided. This apparatus consists of two pieces of steel, &c., connected together by a bar or bars of the same metal; one of these bars passes over the animal's nose, and acts as a lever lifting up and down; the other bar goes into the mouth, but does not in any way affect or press on the animal's mouth; the bar or lever passing over the nose has two rings to which are attached the reins, and it is by these reins that the lever is lifted up or down, and consequently pressed more or less on the animal's nose. The apparatus is fixed to the head stall by buckles, and at each side the branch of the apparatus enters into a long loop on either side of the head stall. *Patent abandoned.*

2710. G. COLLIER and W. NOBLE. *Improvements in means or apparatus for the manufacture of spokes for carriage wheels, which improvements are also applicable to the cutting of wood for other purposes.* Dated November 29, 1858.

Here the wood to be cut is held endwise as in a lathe, and so that rotary motion may be given to it, whilst it is acted upon by two rotary and traversing cutters. One of these cutters in its rotation during its traverse simply acts to reduce the outer surface of the wood to a cylindrical character. The other cutter is also capable of a motion in a direction to or from the wood to be cut, and a projection or follower from the sliding table supporting it is constantly borne towards a model spoke or other form being copied, and which is caused to rotate simultaneously with the wood to be cut, by which the article cut will by this second cutter be cut to the figure of the model. In order to give steadiness to the wood being cut especially towards the centre of its length, it passes through a fixed trace or support of a form suited to embrace the wood just after being operated upon by the first cutter, and before being acted upon by the second. The cutters employed for cutting spokes and such like articles are of a disc form with cutting edges formed across the periphery in an angular direction, and such cutting surface of each cutter is partly cylindrical and partly curved to a smaller diameter, so as to enable them progressively to cut from the outer surface to the depth desired, and the face of the cutter in the direction of its cutting is all round it, near its cutting edge, recessed or dished, so as to admit of sharpness at those parts. *Patent completed.*

2711. W. E. NEWTON. *Improved expansion or cut-off gear for steam-engines.* (A communication.) Dated November 29, 1858.

This consists in certain combinations of vibrating arms, vibrating links, rods, and lifters, whereby the "cut off"

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valve is opened, and subsequently tripped by a continuation of the same movement by which the opening is effected. It further consists in certain devices operating in combination with the lifting and tripping apparatus for rendering the trip motion variable to cut off the steam at different points within the first half of the stroke of the engine. *Patent completed.*

2712. G. HADFIELD. *Improvements in the construction of car-boys, barrels, and other vessels of capacity.* Dated November 29, 1858.

Here the patentee makes the vessel which is to constitute the lining of any required shape, and surrounds it with staves which are bound together by hoops, and into the space between the inner vessel or lining and the casing or envelope he runs liquid asphalte, plaster of Paris, or other suitable filling which will unite or cement the parts together, and thus form a firm structure. *Patent completed.*

2713. W. PARSONS. *Doing away with the smell arising from the melting fat, tallow, &c., and also for an improvement in stirring and straining the same.* Dated November 29, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2714. C. HANCOCK. *Certain improvements in the insulation and manufacture of electric telegraph wires and cables.* Dated November 29, 1858.

The patentee takes two strips of india-rubber, and having coated the inner surfaces of such strips with solution of india-rubber, he lays between them longitudinally the conducting wire or wires, and then presses the solutioned surfaces closely together either by the use of grooved rollers or otherwise. Or instead of two strips he uses a single strip of a greater and of sufficient width to enclose the conducting wire or wires, and having solutioned the same he presses and closes the same together longitudinally upon and around the conducting wire or wires. The patentee also insulates telegraph wires by laying upon them either spirally or longitudinally one or more strips, strands, or coverings of cloth, calico, &c., rendered waterproof and airproof by the usual means. There are various modifications included. *Patent completed.*

2715. J. LEA and W. A. SHERRING. *Improvements in the treatment of vegetable fibres for the manufacture of paper, spinning, and other purposes.* Dated Nov. 29, 1858.

This consists, 1, in subjecting the fibres after they have been boiled in a solution of caustic alkali, soda, potash, &c., and before they are bleached, to the action of a solution of chloride of lime, &c., and of acids containing sulphur or chlorine with or without the addition of soda. 2. In subjecting the fibres, after being treated as above, to the action of a heating engine, and also to the action of a solution of caustic soda or potash. The fibres are then bleached by the ordinary process. *Patent abandoned.*

2716. W. A. HENRY. *Improvements in machinery or apparatus for attaching the soles and heels of boots and shoes to the upper leathers, and in the fastenings employed for that purpose.* Dated Nov. 29, 1858.

The screw-inserting machine consists of a horizontal or vertical rotating spindle fitted with a driving pulley and capable of sliding freely in a longitudinal direction within its bearings during its rotation. The front or lower extremity of this spindle (according as it is placed horizontally or vertically) is fitted with nipping mechanism for holding the fastening to be inserted into the sole, such mechanism being actuated by a pair of double headed slotted plyers which grip two collars carried by the spindle, one collar being fast thereon and enabling the spindle to be slid to and fro in its bearings by hand, whilst the other collar is loose and capable of sliding freely along and revolving round the spindle. To this loose collar, according to one arrangement, is connected by a link one pair of the nippers which hold the fastenings, the connection being so arranged that on sliding the loose collar in one direction or the other it will cause the nippers to open or shut. Or in lieu of the above an inclined sliding collar may be used worked by plyers for acting upon the nippers. A slotted bracket serves as a guide to the plyers during its traverse by hand to and fro in following up the screw as it enters the sole, and in drawing back the spindle again to receive a fresh fastening. The last is held by a screw spindle in a tubular support capable of receiving the leg of the boot. This support turns in a collar in a sliding frame, which frame works in a second sliding frame, the direction of motion of the two slides being at right angles to each other. A rotary motion is imparted to the tubular support by hand direct, or by suitable gearing, and a stationary anti-friction pulley or fixed rest formed with a flange which bears upon the face of the sole is forced against it by a lever spring or weights so as to bring in close contact with each other the outer and inner sole and upper leather at the point where the screw is being inserted. This arrangement also enables the sole when rotated in conjunction with the slides above referred to, to present always the proper part to the action of the screw-inserting machine. One of the fastenings used consists of a short length of wire twisted into a helical form and has one end sharpened. Another form of fastening consists of a screw formed of wire slightly tapering with a gimblet point. *Patent completed.*

2717. J. H. JOHNSON. *Improvements in locomotive engines.* (A communication.) Dated Nov. 29, 1858.

This relates to a construction of locomotive engines intended for steep gradients and sharp curves, and consists principally of a novel combination of the axles with the locomotive framing, and of an improved construction of framing whereby a transverse or lateral play is allowed to the hind axles and wheels, whilst the leading axles and wheels are stationary as regards lateral motion of their axle boxes. *Patent completed.*

2718. J. B. BLANJOT. *Improved petticoats for ladies.* Dated November 29, 1858.

This consists in constructing flounces or puffs on a petticoat made of horse hair, &c. These flounces or puffs are filled with down, feathers, or similar materials. *Patent abandoned.*

2719. L. A. NORMANDY, jun. *Improvements in manufacturing files.* (A communication.) Dated Nov. 29, 1858.

This consists in the use of two machines, the first of which replaces the smith, and the second cuts the files. The first is a species of rolling mill between the cylinders of which the blank files are passed. When these blank files have passed through the cylinders, which have grooves in their surface, they are nearly ready to be cut. The second machine consists principally of a slide rest on which the file is placed, and of a small hammer or stamper which strikes a chisel so as to cut the file. *Patent abandoned.*

2720. C. BEDELLS. *Improvements in the manufacture of elastic fabrics, and in the machinery employed in this manufacture.* Dated November 29, 1858.

Here the elastic fabric is manufactured by inserting a sheet of vulcanized india-rubber cemented on both sides between two other suitable fabrics. The operation is effected by suitably arranged rollers and drums. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated April 28, 1859.

1064. J. Kidd, of Birkenhead, Civil Engineer. Improvements in sewing machines.

Dated June 15, 1859.

1438. E. Humphrys, of Deptford. Improvements in marine steam-engines.

Dated June 16, 1859.

1446. N. C. Szerelmey, of Brixton. Improvements in preparing combinations of materials for preventing rust in iron and other metals, and decay in timber.

Dated June 18, 1859.

1467. J. Luis, of Welbeck-st. A new system of windmill. A communication from B. Z. Lethiers.

1468. J. Cox, of Wenlock-road, City-road, Engineer. Improvements in machinery or apparatus for cutting rags for paper makers.

1469. A. Jeffery, of Commercial-road, Manufacturer. An improved mode of giving rotary motion to projectiles fired from rifled fire-arms.

1470. R. Bradshaw, of Camden Town, Dentist. Improvements in rotary steam-engines and pumps.

1471. R. Harper, Lace Maker, R. Stokes, Lace Maker, and T. Walker, Clock Maker, all of Derby. An improvement in the manufacture of chenille bonnet wreaths, and bonnet feathers.

1473. G. J. Parker, of Stoke Newington, Carpenter. A self-acting apparatus for giving alarm of fire, which is also useful in checking the same.

1474. W. Clark, of Chancery-lane. An improved method of supplying furnaces with hot air. A communication from A. C. Fletcher and G. A. Redman.

1475. P. F. Aerts, of Brussels, Civil Engineer. Improved apparatus for lubricating railway rolling stock, and the moving parts of machinery.

1476. J. Ransley, of Islington, Carriage Builder. An improved brake for retarding railway and other carriages.

1477. J. Ransley, of Islington, Carriage Builder. An improved omnibus.

Dated June 20, 1859.

1479. J. Cox, Saddler's Ironmonger, of Birmingham, and S. and M. Frankham, Spur Manufacturers, of Walsall. Certain improvements in spurs for military and general use.

1480. R. Laming, of Hampstead. Improvements in purifying gas, and in obtaining and reproducing materials useful for that purpose.

1481. C. L. J. Dierickx, Director of the Paris Mint. Improvements in coining.

1482. J. Edwards, of Aldermanbury. Improvements in the manufacture of iron rails.

1483. A. V. Newton, of Chancery-lane. Improved apparatus for blowing off water from steam-boilers. A communication from J. H. Washington.

1484. A. J. Hawkes, of Jewin-crescent. An improved triturating apparatus.

1485. W. Rowan, Engineer, of Belfast. Improvements in the generation of steam.

1486. T. C. Clarkson, of Stamford-st., Blackfriars, Manufacturer. Improvements in the manufacture of boots, shoes, and other articles.

Dated June 21, 1859.

1487. A. P. How, of Mark-lane, Engineer. Improvements in self-supplying distilling apparatus, and in apparatus for cooking combined therewith.

1489. E. Gwyn, of Islington, Gas Engineer. Improvements in breech-loading fire-arms. A communication from H. Gross.

1491. W. E. Newton, of Chancery-lane. An improvement in tailors' and other shears. A communication from J. H. Roome.

1493. A. Parkes, of Birmingham. Improvements in the manufacture of cylinders and tubes of copper, and alloys of copper.

Dated June 22, 1859.

1497. R. Smith, of Longridge, near Preston, Manufacturer. Improvements in apparatus applicable to looms for weaving fancy fabrics.

1499. A. Barclay, of Kilmarnock, Engineer. Improvements in steam hammers and pile-driving machines.

1501. C. Clarini, of New York. Making wrought metal nails by machinery.

1503. F. X. Kukla, Chemist, of Pentonville-road. Improvements in projectiles.

1505. T. Moore, of Pimlico. Improvements in knapsacks and mess-tins.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1500. G. T. Bousfield, of Brixton. Improvements in apparatus for winding thread of cotton or linen, or other fibrous materials, or sewing silk, or similar articles, upon bobbins or spools. A communication from L. C. Ives. Dated June 22nd, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(From the London Gazette, July 5, 1859.)

488. W. Gossage. Utilizing alkali-waste.
492. G. Davies. Evaporating saccharine liquids. A communication.
493. U. Scott. Carriages.
498. H. B. Barlow. Condensing steam. A communication.
514. R. Fielden, jun., and T. Fielden. Pickers for looms.
521. J. Hine. Joint.
524. F. Brignoles. Alcohol. A communication.
531. C. Hall and C. Hall, jun. Steam agricultural machinery.
534. W. Hodson. Rotatory engines.
537. T. Cloake. Stopping carriages.
541. J. Edwards. Stacking ware for firing.
554. E. Roche. Cigarettes.
557. J. H. Johnson. Grease boxes. A communication.
579. J. M. Dunlop. Cleaning fibres.
584. W. P. Savage. Excavating and depositing soil.
585. F. Verdeil and E. Michel. Madder.
599. J. L. Jullion and G. Pirie. Gelatine.
653. W. Clark. Electric lamps. A communication.
706. W. C. Cambridge. Chain harrow.
713. S. Leoni. Articles of tale.
739. J. Evans. Paper.
889. J. H. Young. Setting up and distributing types.
908. W. H. Barlow. Beams and girders.
1272. N. S. Dodge. India-rubber. A communication.
1274. N. S. Dodge. India-rubber goods. A communication.
1299. J. Reynolds. Propelling vessels.
1389. W. H. Dorman and C. Cowper. Traction engines.
1418. H. J. Nicoll. Trousers.
1448. C. Wilkinson. Twisting yarns.
1454. A. V. Newton. Casting tubes. A communication.
1455. J. Harmar and W. Parsons. Fire-arms.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 1, 1859.

17. J. Harris.
19. G. Skinner and J. Whalley.
29. W. Renton, T. Renton, and W. Binns.
33. J. B. Joyce.
34. W. Hood.
35. A. Bedborough.
36. C. de Forest.
38. W. Draper.
47. W. Renton, T. Renton, and W. Binns.
51. W. Spence.
79. E. Agneni.
97. T. Elwell.
150. P. A. Viette.
150. H. Gallon, J. H. Bean, and S. Lumb.
168. J. H. Johnson.
258. C. E. Amos and J. Francis.
312. S. D. Davison.
314. M. Smith.
884. W. E. Newton.
962. H. H. Vivian.
1056. J. and W. Stuart.
1136. J. H. Johnson.
1144. J. Frearson.

Sealed July 5, 1859.

42. W. Corfield, jun.
48. J. Aspinall.
52. I. and A. Holden.
54. J. J. Florence.
60. H. Harden.
78. T. H. Toms.
148. J. Foster.
190. C. O'Hara.
198. B. Lauth.
210. R. Mushet.
251. E. T. Hughes.
294. E. H. Bentall.
372. W. E. Newton.
910. W. Clark.
1040. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1559. W. H. Hubbard.
1572. R. L. Howard.
1582. T. Smith.
1591. G. Sampson.
1594. J. Horsfall.
1597. E. C. Healey and E. Allen.
1608. A. V. Newton.
1623. A. W. Williamson.
1632. P. Prince.
1635. J. Fowler, jun., and W. Worby.
1720. R. Richardson and J. E. Billups.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending July 1, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
2661	0 8	2676	0 3	2690	0 3	2704	0 5	2718	0 5	2732	0 3
2662	0 10	2677	0 3	2691	0 10	2705	0 3	2719	1 0	2733	1 1
2663	0 6	2678	0 6	2692	0 10	2706	0 4	2720	1 4	2734	0 6
2664	0 3	2679	0 7	2693	0 7	2707	0 6	2721	0 8	2735	0 3
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2671	0 3	2685	0 3	2699	0 3	2713	0 9	2727	0 3	2758	0 3
2672	0 4	2686	0 3	2700	0 3	2714	0 4	2728	0 3	2759	0 4
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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 15, 1859.

LAST YEAR'S INCREASE OF THE NAVY.

THE best friends of the late Government cannot deny that Sir John Pakington displayed too little regard for the reputation of his predecessor. To those who know nothing of dockyard operations he successfully commended himself as a very remarkable contrast to Sir Charles Wood; and we doubt not many persons even to this moment imagine that Sir John gave us numerous line-of-battle ships as a clear increase upon what we should have had had Sir Charles remained in power. But this is an altogether vain belief. The work which can be done in the Royal Dockyards, with the ordinary staff of workmen, does not vary with changes at the Admiralty Board. If we put extra strength upon one class of vessels we must take it off another. This is very well understood by persons experienced in dockyard economy—or dockyard extravagance, if any prefer that term—and, of course, by no one better than by Sir Charles Wood himself. Nor was it to be expected that, with his knowledge of the subject, Sir Charles should allow himself to remain long under a cloud which a simple fact or two was amply sufficient to disperse. Hence we were not in the least astonished when we had placed in our hands a printed official paper entitled "A Return to an Order of the "Honourable the House of Commons, dated "6th July, 1859," of the "ships and vessels "added to the navy between the 31st March, "1858, and 1st June, 1859, distinguishing those "which were added in accordance with the "general scheme of works for the year, and "those which were added in consequence of "subsequent orders; and also of the frigates "and sloops which would have been launched "according to the general scheme of works for "1858-59, but which were deferred on account "of the men being removed to convert ships of "the line."

An intelligent observer will see at a glance that this return must let the reader into the whole secret; for it tells us not only what Sir John Pakington gave us in his fourteen months of power, but also what he deprived us of. Let us look at both.

The screw ships added to the navy between the 31st March, 1858, and 1st June, 1859, according to Sir Charles Wood's original scheme of works for 1858-59, were as follows:—

SHIPS OF THE LINE:

The Donegal	of	101	guns and	800	H. P.
„ Windsor Castle	„	100	„	500	„
„ Revenge	„	91	„	800	„
„ Edgar	„	91	„	600	„
„ Hood	„	91	„	600	„
„ Hero	„	91	„	600	„
„ London	„	90	„	500	„
„ Lion	„	80	„	400	„

FRIGATES:

The Topaze	of	51	guns and	600	H. P.
„ Forte	„	51	„	400	„
„ Orlando	„	50	„	1,000	„
„ Mersey	„	40	„	1,000	„

CORVETTES:

The Cho	of	22	guns and	400	H. P.

SLOOPS:

The Icarus	of	11	guns and	150	H. P.

The screw ships added in consequence of the subsequent orders of Sir John Pakington were:—

SHIPS OF THE LINE CONVERTED:

The St. George	of	90	guns and	500	H. P.
„ Neptune	„	90	„	500	„
„ Trafalgar	„	90	„	500	„
Queen	„	86	„	500	„

Then comes, as the set-off to these four converted ships, the following frigates and sloops, which ought to have been launched according to Sir Charles Wood's scheme of works, but which were deferred on account of the men being removed by Sir John Pakington to convert those four ships, viz:—

FRIGATES:

The Bacchante	of	51	guns and	600	H. P.
„ Galatea	„	26	„	800	„

CORVETTES:

The Charybdis	of	21	guns and	400	H. P.
„ Jason	„	21	„	400	„

SLOOPS:

The Rinaldo	of	17	guns and	200	H. P.
„ Greyhound	„	17	„	200	„
„ Pantaloon	„	11	„	150	„

Here, then, we find that, in plain language, we have gained the St. George, Neptune, Trafalgar, and Queen, at the expense of the Bacchante, Galatea, Charybdis, Jason, Rinaldo, Greyhound, and Pantaloon. In other words, we have four converted line-of-battle ships carrying 356 guns, and engines of 2,000 horse-power, in place of two frigates, two corvettes, and three sloops carrying 164 guns and engines, of 2,750 horse-power. We do not intend to assert or imply that the exchange was unadvisable, although, seeing that the French beat us more in respect to frigates than of line-of-battle ships, grave doubts may fairly be entertained on that point. But what we do wish to have understood is, that Sir John Pakington, notwithstanding all his boasting, has really given us no miraculous increase of ships of war. So many mistakes are made, and so much false intelligence is propagated on this topic, that we deem it proper to aid in dispelling all illusions that hover about it.

There is, however, one fact which will diminish the strength of any argument which may be founded upon this "Return"; and that is the fact that the general scheme of works got out by the Admiralty is never fully carried out. In theory the year's work is always greater than it is in practice. This must not be forgotten, or injustice will be done to Sir John Pakington.

It might fairly have been expected that the debate of Friday evening last on the navy estimates would have thrown a little additional light upon this subject had any member less young in officialism than Lord Clarence Paget moved the consideration of the estimates in committee. But his transition from the most extravagant of all fault-finders to that of chief fault-defender has been made so recently that little was to be anticipated from him beyond an attempt to get through his business as smoothly as possible. The following is his curious way of settling the question:—

"They had often heard little disputes between "high authorities as to the number of ships "which had been built by this or that Govern-"ment. He remembered that the right hon. "baronet opposite (Sir J. Pakington) claimed "some line-of-battle ships which were the pro-"perty of his right hon. friend the Secretary of "State for India. They were built almost en-"tirely while the latter right hon. baronet was "in office; but, as they were finished under the "administration of the right hon. baronet the "member for Droitwich, he claimed them as "having been built during his time. For the "purpose of putting an end to these discussions, "and giving the House an idea of what build-"ing was really carried on in our dockyards, he "had endeavoured to ascertain what amount of "tonnage was built there in a year. During "the past year, 1858-9, we had built there of "line-of-battle ships 10,604 tons; frigates, "5,851; corvettes, 1,193; sloops and gun ves-"sels, 1,511; total, 19,159 tons. If the scheme "of the Government were carried out, and no "unforeseen contingency should arise, there "would be built of line-of-battle ships 19,606 "tons; frigates, 15,897; corvettes, 5,130; "sloops and gun-vessels, 5,651; total, 46,284, "or more than double the tonnage built last "year. During the present year we were con-"verting five sail of the line and four 50-gun "frigates. This was entirely exclusive of con-"tract built ships. Of marine engines we had "at present in course of construction 14,570 "horse power, and orders had been given for "2,160-horse power more, making a total of "16,730-horse power."

Whether Sir Charles Wood will deem this mysterious statement sufficient to "put an end "to these discussions" appears extremely doubtful. We are rather disposed to think he will deem the statements which we have ourselves given above much more satisfactory and conclusive. Sir John Pakington seemed scarcely convinced by Lord Paget's argument, for he deemed it necessary again to repeat, by way of reply, the oft-told tale of his own disinterestedness and perfect freedom from everything like self-laudation, and even from party feeling, in connection with the great question of our defences.

LORD CLARENCE PAGET ON THE NAVY.

THE promulgation of an official justification for the enormously increased navy estimates of the ensuing year devolved upon Lord Clarence Paget on Friday last. Rabid reformers always become the very worst red-tapists when projected into office; consequently, we expected but little from the new Secretary to the Admiralty, and we have not to complain, therefore, of any disappointment.

So far as our immediate professional interest in the subject goes—disregarding, as we necessarily do, all considerations of the manning and disposal of our ships—the tale is soon told. After informing us that the Government at this moment have 10 sail-of-the-line ready for commission; that they will have three more in the autumn; and that there is one under repair, so that the total of the line-of-battle ships and screw-ships of the line now afloat was 40; and further, that the Admiralty are building 10 more ships of the line, and have six more in process of conversion, making a grand total of 56 sail-of-the-line, of which there will be, at the end of the financial year, 50 sail-of-the-line afloat, Lord Paget said he was about to depart a little from the rules of the Admiralty. He had always observed that the Admiralty were willing enough to look at the present, but that they were always reluctant to say anything about the future. They spoke of the future in a guarded manner, as if they were afraid they should not be able to do what they said they would do. It was, of course, impossible for a Board of Admiralty to say positively what they would be able to do in the course of the current year. There were always various contingencies of repair that could not be exactly calculated; but, as a general rule, he believed that if a little more method were introduced, they would be able to arrive at a very fair average of the number of men who would be wanted for repairs, and that they would not be obliged to take the men who were building ships to repair others. This was one of the questions which the noble Duke at the head of the Admiralty, and the Board of Admiralty, would take into their serious consideration. He (Lord Paget) believed there would be no necessity to take away the hands from the building departments to the ships, which he hoped the Admiralty would be able to build, and he trusted that, at the end of the financial year, there would be 50

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ships of the line afloat, 37 frigates, and 140 corvettes, sloops, and gun vessels—50 sail-of-the-line, independent of the block-ships.

But we are not, according to Lord Clarence Paget, to suppose that our naval strength is limited to these ships and vessels. From a return moved for by the hon. member for Penryn a few days ago it appeared that the number of steamers over 1,000 tons was 159, that the total number of registered steamers was 1,854, and that there were 231 steam vessels in the merchant navy, any of which might be armed with Armstrong's guns, and which would prove a valuable addition to the defences of the country. There was another source from which the navy of this country might be very largely increased at any moment—viz., the ships from the merchant yards. He produced a return which could not but be interesting to the House. There were 10,000 shipwrights in Great Britain in addition to those employed in the Royal dockyards. Now, the old shipwright maxim was that 1,000 shipwrights would build eight ships of 1,000 tons in 12 months; consequently 10,000 men would build 80 corvettes of 1,000 tons each in 12 months, or between six and seven corvettes per month. If we were pressed for ships there could be no doubt that, giving the shipwrights a little while, say four months, to start with, they would be able to build half-a-dozen very large corvettes per month in the merchant yards, and the steam machinery that could be produced would be in proportion. His (Lord Paget's) object was to show what the public were, he thought, anxious to know—whether this country was really in a state that befitted its honour and dignity. He believed that the navy was now in that state.

The next portion of Lord Paget's speech which invites our notice is that relating to the employment of extra shipwrights in our dockyards during the ensuing year. Besides the ordinary wages of shipwrights there was an extraordinary charge, called by him the "reconstruction" charge. There was also a large sum in the supplemental estimates under the head of wages to artificers. He explained the history of this transaction as follows:—Up to March last the men in the dockyards were working in the usual way on day pay. But in March the late Government thought fit to commence a system of task and job work, and also to enter a considerable number of additional artificers. There were 1,484 shipwrights entered in addition to a corresponding number of other workmen. In April, again, the late First Lord of the Admiralty considered it important, probably from circumstances connected with foreign affairs, to make additional exertions; and then commenced a system of over-hours, that was to say, besides the institution of task and job work, men were allowed to work over hours, and so the dockyards went on until May, when there came a large increase of no less than 1,350 shipwrights and other artificers and labourers; making a total of 17,690 workmen now employed in the dockyards against 14,128 employed in the month of March. This was a very great increase, and he (Lord Paget) believed that the increase was absolutely necessary. He thought that Sir John Pakington deserved the gratitude of the country for having taken this matter in hand, and for having come to the decision of raising the amount of workmen in the dockyards with the least possible delay. The present Government, on coming into office, looked very carefully over this vote, and they sent for the Surveyor of the Navy, Sir B. Walker, and asked very particularly for what period this additional expense would provide pay for the additional men; and Sir B. Walker stated that it would only pay the men up to the month of October. It would be very unwise that that body of men should be discharged, when the short days of winter were coming on, when over the country work was scarce, and, moreover, when there would still remain in the dockyards a vast amount of work to be done; and therefore the Government had resolved to keep them on till the end of the financial year, and to ask for an additional sum of £100,000 on that account. This was a sufficient answer to the statements which had been made, that the present Government intended to cut down the expenditure in the dockyards, and to cease the efforts which were being made to put our navy upon a proper footing.

The new Secretary's speech was most meagre in reference to ships building by contract, and to new works, improvements, &c. The substance of it was, "The sum taken in the original "estimates for ships building by contract was "£252,000, which was the first instalment for "two iron-cased frigates, one of which would "be launched on the 18th of April next—the "total cost of which he was not then in a posi-"tion to state. In addition to this sum there "was in the supplemental estimates a vote for "eighteen gun vessels of a very superior class, "which were to be built by contract. With "regard to vote No. 11 for new works, improve-"ments, and repairs, the new Board of Ad-"miralty, having had no time to visit the "different dockyards, had formed no indepen-"dent judgment. Each year we built larger "ships, and consequently had to enlarge our "docks; and he supposed we should go on in "the same way until there came a change, and "ships were reduced in size." From this we conclude that a second "steam ram"—as newspaper writers are so fond of calling the vessel now building on the Thames—is not to be undertaken this year. No further attempt is, it appears, to be made with the view of resisting those formidable "*frégates blindées*" which the French are building with all despatch.

DECIMAL COINAGE.

IN pursuing further the question of a decimal coinage, let it not be supposed that we are wedded to the idea that its introduction is an absolute necessity, because such is not the case. It has been shown in these columns that there exists an urgent need of a mechanical reform in regard to the silver and copper currencies of the kingdom, and the consideration naturally arises, "Is it not prudent in conjunction with that mechanical reform, which *must* be effected, to reform altogether the scale upon which those currencies are based?" If it can be demonstrated by Lord Overstone, or Lord Anybody, that in making choice of a new metallic currency, and dismissing altogether prejudice, old associations, and habit from interference with the subject, it would be advisable to copy the present antiquated duodecimal system, and perpetuate it—if we say this can be incontestably demonstrated, then are we duodecimalists too! Hitherto, this assuredly has not been done, and, in spite of the final report of the *last* Decimal Coinage Commissioners, there are in both Houses of Parliament, and in the monetary and commercial sections of the community, many who dispute altogether the superiority of the existing system to that of the pound and mil, as proposed by Sir John Wrottesley in 1824, and supported by a long train of scientific men since. It is not in the spirit of controversy that the matter is here introduced; there has been too much controversy already. Decimal systems—for there have been several placed before the public—were discussed, written about, and lectured upon with a species of literary and mutual *pounding* and *milling* which blinded the disputants to facts, and made them the excited advocates of fanciful theories, rather than philosophical students in search of the truth. Calmly, and apart from any pugilistic thoughts, would we touch the decimal question, and having last week given something like an historical *résumé* of the agitation in favour of it, now proceed to remark upon the report which, for the moment, seems to have extinguished that agitation.

In the first place, as it appears to us, the Commission was far too limited as regards the number of its members. *Three* gentlemen only, however talented, were not competent to deal with the weighty business intrusted to them, and the retirement of Lord Monteagle before any but the preliminary report was agreed upon, made the court still more inadequate to the task. It is not likely that any disparagement of so eminent a man as Lord Overstone will find utterance here. Noble by reason of his vast ability as by his rank, his lordship's fame is beyond detraction. We cannot regard Lord Overstone's report nevertheless—for virtually the final report of the Commission is *his* alone—we cannot regard his report as decisive of the fate of decimalization in England. Unlike the *Saturday Review*, we consider the question of pound and mil still as an open one, and shall endeavour, by making some perforations in his lordship's report, to let in a little more light on the vexed subject.

Perhaps there is no one man who has so thoroughly considered the question of decimal coinage as Sir John Bowring, who, we rejoice to see, has returned home after the successful accomplishment of one of the most arduous tasks which could fall to the lot of a statesman, and who we trust will not fail to meet a due reward at the hands of his countrymen. Sir John Bowring, it will be remembered, published in 1854 a work on the decimal coinage, and the amount of laborious research and of scientific acumen which his book displayed places its author almost at the head of the supporters of the decimal system. Back to the very infancy of civilization in the nations of antiquity does Sir John look for evidence of the superiority of the decimal scale of notation, whilst the Scriptures themselves are put under contribution in support of his arguments. With this ancient data we, however, are not intending to load our columns. It will be enough for us to prove that, in the present position of commercial affairs in England, the introduction of a decimal system of coins would be a boon.

We have seen that the great arguments of most of those who are opposed to the reform or remodelling of the coinage upon the decimal system, are the amount of confusion which the act of transition would create, and the vexation and loss which would fall upon the small shopkeeping classes. In our opinion, these evils would be found more imaginary by far than real. Those amongst us who have travelled on the Continent are quite aware of the facility with which one falls into the method of calculating the cost of everything in the monies of the particular countries through which he passes. Even our friends the "navvies," that useful body of men, to whom not only England but the world is largely indebted—the "navvies" have been found to possess, after one or two lessons, the 'cuteness necessary for preventing their being victimised by the natives of those remote districts of Europe where they have been engaged in their useful occupations, and where decimal coinages existed. Engineers and contractors have furnished abundant evidence on this head.

In the "draft report" of Lord Overstone, facts of this kind—which to our thinking are the

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strongest proofs of the absence of difficulty in making the change at home—facts of this kind, we say, are lightly brushed aside because the unit, or starting point, of those coinages is not as it would in the pound and mil scheme be, the pound sterling. There is, no doubt, some little ground for thus getting rid of the mass of evidence which travellers of every grade will be willing to furnish in favour of a decimal coinage, but indeed to us it seems that his lordship was driven to extremities when he availed himself of that ground. Without coming to the penny scheme, which, though having some advantages over the pound and mil scheme, is yet admitted to be inferior to it in many other respects, let us deal at once with the latter. It was stated in the report of the Select Committee of the House of Commons, dated August, 1853, that that committee was "unanimous in recommending the pound sterling as the unit. Considering," that report went on to state—"considering that the pound is the present standard, and therefore associated with all our ideas of money value, and that it is the basis upon which all our exchange transactions with the whole world rests, it appears to the committee that any alteration of it would lead to complications and embarrassments in our commercial dealings; in addition to which it fortunately happens that its retention would afford the means of introducing the decimal system with the minimum of change. Its tenth part already exists in the shape of the florin, while an alteration of four per cent. in the value of the farthing will serve to convert that coin into the lowest step of the decimal scale which it is necessary to represent by an actual coin, namely, the thousandth part of a pound. To this lowest denomination the committee purpose, in order to mark its relation to the unit of value, to give the name of *mil*. The addition of a coin to be called a cent, of the value of ten mils, and equal to the hundredth part of a pound, would serve to complete the list of coins necessary to represent the monies of amount, which would accordingly be pounds, florins, cents, and mils."

Such was the very distinct and unmistakeable definition of the pound and mil scheme of 1853, and such is a clear exposition of that scheme as it stands now, and was dealt with by Lord Overstone—we beg his lord hip's pardon—by the Commission which has recently delivered itself of its final report.

We have not time nor space to follow Lord Overstone's wanderings through France, Sardinia, Belgium, the Netherlands, Switzerland, Russia, and America, in his search for condemnatory evidence of decimal systems in general, and of the proposed pound and mil system in particular. It is quite certain that foreigners generally prefer the particular decimal plans which may be employed in their own countries; and there has unquestionably been much skill employed in framing many of them to suit the peculiarities of the peoples of those countries. It is admitted by his lordship that men of science throughout England are almost universal in their faith in the practicability of a decimal coinage, as also of its great value and simplicity as compared with the existing system. Among these scientific men, indeed, may be named the late, and the present master of the Mint, Sir John Herschel and Dr. Graham, Professor de Morgan, Sir William Hamilton, and many others. The scholastic profession, probably from their intimate acquaintanceship with decimal notation, are strong advocates of a decimal coinage. The coins themselves, they say, would teach the people generally how to avail themselves of decimal calculation, whilst the latter would save them time, which is money!

There are many other points in regard to this important subject which ought to be touched upon; but feeling assured that the present Government will not rest satisfied with the able but one-sided report of the last Commission, but at once appoint another, of which Sir John Bowring shall be a member, we reserve them for consideration at some future day. Our own decided conviction is that the further introduction of the decimal system has been too long delayed, and that the late Commission has raised about it a cloud of mystery and doubt which one year's practical experience of the pound and mil system would cause to vanish like the mists on the mountain tops on the appearance of the morning sun.

So far from sweeping away the florin, of which Lord Overstone, with a good old-fashioned prejudice in favour of the half-crown, professes himself tired, we hope to see the day when the supplementary coins alluded to shall issue from the Mint, and prove themselves the best arguers in favour of the decimal system.

THE LOCOMOTIVE: ITS PLACE IN HISTORY.

IN Mr. Buckle's "History of Civilisation," the following bold opinion is expressed: That the locomotive steam-engine has done more to unite mankind than all that philosophers, poets, and prophets have taught from the beginning of the world; and this is so emblematic both of the worth and of the defects of this noble book, that we give it in these pages as a sort of window-peep into the whole.

This sentiment well expresses the writer's healthy, brave appreciation of things material and secular. No doubt, in the theory of life we have been educated in, there has been a most unholy divorce of the material life of man from his mental life. In nature, in idea, these two are one; and to make them one in universal fact is the great task of mankind. The street, the shop, or the cloth-mill is as holy a place as the church, if intelligence, heartiness, and conscience be there. The steam-engine, looked at as the product of mind, is as holy as a prayer-book; and when employed by mind for noble ends, performs a true divine service. In short, bring the whole man into any material act, interpenetrate it with energy, intellect, heart, conscience, and the act is no longer material, but as divine as the breath of prayer.

It is said of Dr. Arnold, that when he first saw the railway-train shoot by, he exclaimed, "That's the death-blow to feudalism." In the same spirit is the locomotive the favourite of Mr. Buckle. He is the firmest, most entire, and most pitiless foe of all artificial and false restrictions. Undo every fetter you have laid upon man, is the voice of his book from beginning to end of it. The inmost life of it is a protest against all false restraints. Thus Adam Smith, the father of our modern free trade, in writing the "Wealth of Nations," is extravagantly said to have given us, considering all its results, the most important book that ever was written. And just as inveterate is Mr. Buckle against false social as false fiscal restrictions. So democratic is he, it really seems a pure misfortune in his eyes to be born with a title and a name.

But, returning to our point, will the fondest believer in machinery thus exalt the steam-engine above the philosophies and poetries of the world? Mr. Buckle has shown, towards the close of his book, how the French, wholly ignorant of us English people during the reign of Louis XIV., after his death suddenly became acquainted with and enamoured of our manners and institutions, our independence of speech and thought; and that this, working and fermenting in the best French minds of the 18th century, was, more than anything else, the cause of the great Revolution. What had the railway and steamboat to do with this? Or, to take an instance nearer home, has not the steam-engine been very busy recently in bringing French and Austrians together, and was it then "the bond of unity?" We would not be profane enough to ridicule a sacred fact. The steam-engine is a divine element in the civilization of the world. But the writings of Locke and Shakspeare are diviner than it; and only in the hands of a people transformed by thoughts like theirs can the steam-engine play its true part. This is the one great defect of this "History of Civilization," that it overrates what is material and external. It makes the character of whole nations depend upon food and climate. It sets up a doctrine of averages drawn from statistics, as throwing more light on the moral nature of man than all the accumulated experiences of former ages. It traces to external accident what the inspirations of individuals and races have achieved. It calls Cromwell's war a secular war; and Bacon's and Shakspeare's books, secular books. It makes the superiority of Protestantism over Catholicism to consist purely of a superior common-sense and wider tolerance of difference of opinion. It exalts tolerance above conviction. It exalts common-sense above reason and imagination; "useful knowledges" above metaphysics and poetry. And this, too, with a strange inconsistency; for the main figures of this book are men of a metaphysical bent: Montaigne, Descartes, Bichat, Locke, and Newton. No doubt man is a unity; and 'tis foolish to pit one faculty and possession against another. But 'tis equally true that there are grades and stairs of existence. There are things for the senses; things for the logical or ratiocinative power in us; and there are things for belief, wonder, and love. Adam Smith gave us much; Watt still more; but Shakespeare, Homer, and Plato far more than they. Community of trade, community of intercourse, community of knowledge and opinion are unspeakably good; but community of perception, conviction, belief, good-will, far better. These come from within, not from without; are in greater plenitude in some races and ages than in others; in some individuals than in others. They are checked or furthered by innumerable conditions and circumstances, but created or killed by none of these. They do not quite depend upon "climate and food." They can come upon an Egyptian, or an Arabian, eating dates, surely, or upon a Hindoo that subsists on rice, as upon a European eating bread in his temperate climate. Their rise and decline are not calculable by any doctrine of averages. They come as the summer lightnings and the summer breezes, when and where we cannot foretel.

THE ROYAL AGRICULTURAL BENEVOLENT COLLEGE.

THERE is no greater characteristic of the present age than the rapidity with which long-rooted prejudices have been removed, and their places taken by well-grounded and enlightened views. And in no one especial direction is this more remarkable than amongst the agricultural community of Great Britain. It is within the recollection of even ourselves that the farmers, as a body, persistently opposed every innovation against prescribed rules in reference to their soil—rules that were told off upon their fingers, and were revered and followed only because their fathers revered and followed *their* fathers before them. When it was first made apparent that the plough could be rendered less unwieldy, and

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do as much with two or even one as had before taken six horses to manage, the sharp edge of improved mechanical appliances entered not only the earth, but the minds of the most important members of the landed proprietors also. Prejudice, driven from the centre of the citadel, took refuge in the outposts, and amongst the working men reigned triumphantly for a time. The destruction of machinery by the illiterate and ill-advised labourers perhaps hastened its development, inasmuch as opposition is a great element in producing the essentials of perseverance in the English character. Chemistry followed close upon mechanics, and the wonders worked in consort with agriculture are now before the world. It is not, then, a matter of surprise to find the *trio in juncta* linked and bound together as with one mind, and zealously engaged in consecrating so great a victory.

"The Royal Agricultural Benevolent College "for the Relief of Decayed Farmers, their "Widows and Orphans," is the embodiment of a co-operative thankfulness for a grand and continuous social progress. The thought, we believe, has emanated from Alderman Mechi, who, it would seem, has by the application of a simple, soul-stirring appeal from Tiptree, practically effected the humane object of his advocacy. Already the first men in literature and the arts, whether in the ranks of wealth or genius, have given in their adhesion to the proposal; and so great has been the instant success attendant upon the promulgation of the scheme that, strange to say, for once, it has left the important labours of the journalist far in arrear. The pen has to record what *has* been done, not that which it is desired to do.

We cannot do better than reprint a few extracts from the addresses of Alderman Mechi upon this subject, and we do it not as a work of supererogation but as placing on record the fact that, with energy and tact, great good may be effected, and that as the field of philanthropy is by no means over-cropped, others may profit by this example of the Christian farmer, who has left the gate open for those who would glean, and showed the way to yet further tillage for the production and fruition of good works.

"If we reflect for one moment," says Mr. Mechi, "wherein can we discover a reason why "the industrious farmer should be specially "screened from the frowns of fortune, or those "vicissitudes which are the painful lot of every "other class? Why should he expect to be "exempt from that stern misfortune and bitter "poverty which we see so frequently too pain-"fully illustrated in every other department of "daily life? None can say that his risks are "less frequent, or his chances of success more "certain. Why, then, should he in his suffer-"ing and his tribulation be shut out and ex-"cluded from the enjoyment of that support "and sympathy which are diffused so profusely "throughout the length and breadth of the "land, for the benefit and solace of every "suffering class but his own? Let us remove "this reproach. Let us assume that place in "so noble and charitable a list which the in-"fluence and the dignity of agriculture demand, "and I am assured the bare mention of such a "project for the amelioration and relief of those "who, while suffering, complain not, will "speedily realize such a happy and much-"needed consummation. Towards the fulfil-"ment of such an object, I have received "promises of hearty and zealous support from "some of the leading agriculturists and imple-"ment manufacturers in the kingdom, who "most cordially sympathize with the sugges-"tion. One farthing per acre, on the 48,000,000 "acres farmed in this country, would produce "£50,000, or, if one-fourth only gave one penny "per acre the same amount would be produced. "It is a cause in which the humblest may do "good, the 50 pennies from the 50-acre farmer "will, *in its proportion*, do as much real good "as the contribution from the 10,000-acre hold-"ing; do not, therefore, permit a false delicacy "to crush a good intention, but give it exist-"ence in a cause that will bear you tenfold "interest hereafter."

THE CASE OF HENRY CORT,
AND
HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

No. V.

HENRY CORT, the author of these inventions and of that system which has been described as constituting the third epoch in the history of the British iron manufacture, was born in 1740; his father was a builder at Lancaster.

About the year 1765, Henry Cort had established himself as a navy agent in Surrey-street, Strand, and in 1768 married Elizabeth Heysham, the daughter of a solicitor in Staffordshire, and steward of the Duke of Portland. The issue of that marriage was as follows:—

Henry Bell Cort	born	29th Dec., 1769.
Conningsby Cort	„	12th Nov., 1770.
William Thomas Cort	„	19th Dec., 1771.
Eliza Jane Cort	„	21st April, 1773.
Harriet Ann Cort	„	22nd April, 1775.
John Harman Cort	„	Jany., 1777.
Maria Cort	„	13th June, 1778.
Charlotte Cort	„	12th Oct., 1779.
Frederic John Cort	„	10th Oct., 1781.
Caroline Cort	„	18th Jany., 1783.
Richard Cort	„	20th April, 1784.
Louisa Cort	„	21st June, 1786.
Catherine Frampton Cort	„	24ht Feb., 1790.

Of those thirteen, the son, Richard Cort, born 20th April, 1784, and three daughters, are the only survivors, their united ages being upwards of 290 years.

After ten years of success as a navy agent, during which period he amassed a considerable sum of money, Henry Cort was induced, about the year 1775, to relinquish his navy agency business and to prosecute a series of experiments in the manufacture of iron at Fontley, near Fareham, Hants, in partnership with one Adam Jellicoe, of the Pay-office. He erected a forge and mill on the estate of Mr. Delme; he purchased the premises and the goodwill of a business at Gosport, which, with the debts for iron supplied to the navy, were valued at upwards of £39,000. In his business of a navy agent, Cort had become well acquainted with the inferiority of the British and the superiority of the foreign iron, and he entered with zeal and enthusiasm into the attempts to improve the home manufacture of iron, so as to make Great Britain independent of foreign nations for the supply of this most important article. It is much to be regretted that no record exists of the steps by which Cort arrived at the series of processes constituting his invention; prudence would prevent the disclosure of the results of his experiments until after the patents should have been obtained, and recourse must be had to the specifications as the only authentic records of the invention.

Cort's first patent bears date the 17th January, 1783. It is for "A peculiar method and process of preparing, welding, and working various sorts of iron, and of reducing the same into uses by machinery, a furnace and other apparatus adapted and applied to the same purpose." The specification enrolled the 16th May, 1783, four months after the date of the patent, describes the process to be pursued in the manufacture of various enumerated articles, and affords the most conclusive evidence of the laborious detail with which the invention had been matured. Commencing with what are termed "large uses," such as shanks, arms, rings, and palms of anchors, it describes the laying bars of iron of suitable lengths, forged on purpose, and tapering, so as to be thinner at one end than the other, one over another in the manner of bricks in buildings, so that the upper bars everywhere cover the joints of those underneath, and thereby make a faggot, two bars wider than those which compose the beds, being laid at the bottom and top and bolted so as to be better laid on the anvil and receive the first strokes of the hammer; the faggot is bound together as close as possible. The system here described is now known by the technical terms of "piling" and "faggoting." The faggots so prepared by the system of piling to the amount of half-a-ton more or less, are to be put into a common air furnace and usually called a balling furnace, and there is brought to a welding heat at the same time with greater despatch than can be effected in a hollow fire with a blast. The giving this welding heat in a balling furnace according to the method and process specified, is stated to be part of the invention. The specification, after describing the method adopted where several weldings are to be made, concludes the part of the description by stating as follows:—"The whole is neatly finished under a large hammer without the use of either chaffery or hollow fire. And I find that the largest uses thus finished by me are in all respects possessed of the highest degree of perfection. I also have found that the fire in the balling furnace is better suited for its regularity and penetrating quality to give the iron a perfect welding heat throughout its whole mass without burning in any part, than any fire blown by blast, insomuch that if bar or other massy iron is bound into a faggot of five or six inches diameter by an old cask hoop the sixteenth part of an inch in thickness, the one will acquire a complete welding heat and the other not be burnt or wasted, and the iron is welded to the centre instead of, as in the usual method practised being covered only with an incrustation." In the above is the announcement of the system of piling, faggoting, and heating, in an air or balling furnace, of iron to be forged by hammers into various uses, as a means of securing uniformity of constitution in opposition to the old system of heating in a hollow fire under a blast. The specification having remarked on the imperfect removal by the forge hammer of the impurities—earth, salt, and sulphur—describes a process of cleansing if the iron be in a dirty state, as conducive to producing iron of purer grain and more perfect contexture proceeds to describe the working of the faggots by passing through rollers, and states as follows:—"and by this simple process all the earthy particles are pressed out and the iron becomes at once free from dross, or what is usually called cinder, and is compressed into a fibrous and tough state." Such is the simple process of manufacture producing a result which is thus stated:—"Accordingly, a bar of the worst ordinary iron in which the grains of metal are large and much separated by the impurities with which it is impregnated being passed through the simple operation becomes instantly of good quality, and two or more of the same bars or of any pieces of impure iron heated in the same manner, and passed through the rollers together, become at once welded into one solid body and meliorated into good tough iron, without being previously cleansed in the scouring barrel or otherwise. If the iron to be welded by this method is intended for plates of any kind, it is bundled or laid together,

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before being put into the furnace, in the shape and size best suited to the use for which such plates are intended, and passed repeatedly through the common rolling and slitting mill rollers with flat surfaces till it acquires the requisite degree of thinness. If it be intended for flat or square bars, rods, hoops, or the like, as soon as welded and made sufficiently thin under the rollers, it may at the same heat be passed through the slitters, and from them again through the rollers, if needful, for proper uses. When the iron thus to be welded through the rollers is designed for bars, half flats or thimble iron, with feather edges, a groove of the requisite dimensions is made in the under roller, through which groove the iron is to be passed in the state of welding heat."

The specification also states :—"Much of the success of the operations described depend on the iron being properly cut, faggoted, banded, or placed together ;" and that in mills of sufficient power, with rollers large enough to admit of grooves and collars for the purpose, very great sized iron may be welded in this manner as well as under the hammer, the heat being the same in both cases, and claims such process as his own invention, and put in use by him only. It is material to observe that Cort, in this specification, speaks of the rollers, furnace, and separate processes as well known ; there is no claim to any of them separately, the claim is to the reducing of the faggots of piled iron into bars, and the welding of such bars by rollers instead of by forge hammers. This invention as then announced and described in the specification in the above terms is a faithful description of the manufacture as now practised. Cort's own language may be applied to the manufacture as practised after an interval of 75 years ; the grooved rolls, whether of the rectangular, diamond, or double flanged shape, are the rolls described by Cort and used for the same purposes ; each presenting a specific section through which the iron at a welding heat is constrained to pass, being unable to escape on either side, and becoming deprived of its impurities, condensed, elongated, and welded, precisely in the manner described by Cort. It should be remarked that Cort in this specification takes and treats bar-iron as then existing ; this invention begins with and has reference to a method of making "uses," as they are termed, by piling, faggoting, and rolling, not to the manufacture of the bar from the cast-iron which forms the subject of the next patent.

Cort's second patent is dated 13th Feb., 1784 ; it is for "A new mode and art of shingling, welding, and manufacturing iron and steel into bars, plates, rods, and otherwise, of purer quality, in large quantities, by a more effectual application of fires and machinery, and with greater yield than any method before attained or put in practice."

The specification enrolled on the 12th day of June (four months after the date of the patent), relates to the preparing, manufacturing, and welding of iron from the ore, as well as from raw and pig metal, and also from every other sort of cast iron, together with or without scull and cinder iron and wrought iron straps. The furnace employed is the reverberatory or air furnace, hollowed or dished out at the bottom, so as to contain the metal when in a fluid state. The furnace having been brought to a proper degree of heat, the fluid metal is conveyed into the air furnace, or the metal may be fused in the furnace, the doors of which are then closed and the metal is sufficiently fused, when the whole is worked and moved about by bars and other fitly shaped instruments through apertures, which operation is continued until an ebullition effervescence, or such like intestine motion takes place, accompanied by the emission of a bluish flame or vapour ; the operation is continued, as occasion may require, of raking, separating, stirring, and spreading the whole about the furnace till it loses its fusibility, and is brought into nature ; the iron when so brought into nature is collected together in lumps called loops, of sizes suited to the intended purposes, and so drawn out of the doors or furnaces. The specification declares the above method and process of preparing, manufacturing, and working of iron, in substitution and instead of the use of the finery, to be Cort's invention, and never before used or put in practice by any other person or persons. The specification proceeds to state that the iron so prepared may be afterwards stamped into plates, and piled and worked in an air furnace ; but that the method and process invented and brought to perfection by Cort is to continue the loops in the same furnace, or to put them into another air furnace or furnaces, and to heat them to a white or welding heat, and then to shingle them under a forge hammer, or by other machinery ; and after having been shingled to the size of the grooves in the rollers are worked through the grooved rollers, in the manner in which Cort used bars or wrought iron faggoted, and heated to a welding heat ; which manner of working any sort of iron in a white or welding heat through grooved rollers, Cort declares to be entirely his own invention. The following is the concluding paragraph of the specification : —"Iron and steel so prepared, made, wrought, and manufactured by such effectual application of fire and machinery, will be discharged of the impurities and foreign matter which adheres to them when manufactured in the methods commonly practised. The steel is of an excellent quality, and the iron will be found to be good tough iron in bars and uses, whether large or small, and in all sorts of merchant iron, whether it be made from metal of a red short or cold short nature ; and blistered steel, whether made from iron prepared according to the above process, or from any other iron when faggoted together, heated to a white or welding heat, rolled in that heat through grooved rollers, according to the method invented by me, and slit through the common cutters, is equal to steel manufactured by forge and tilt hammers. The whole of which discovery and attainment are produced by a more effectual application of fire and machinery, as described by me, than was before known of or used by others, and are entirely new and contrary to all received opinions amongst persons conversant in the manufacture of iron ; and the whole of my method may be completed without the necessity of using finery, charcoal, cokes, chaffery, or hollow fire, and without requiring any blast by bellows or cylinders, or otherwise, or the use of fluxes in any part of the process. The whole operation to be performed with one or more furnaces, according to the quantities or dispatch required."

On the 12th day of June, 1784, Cort had published in the specification of his two patents the processes of which he asserted himself to be the inventor. No one can peruse these records of his invention without being at once struck with the precision and completeness of the disclosure thus made to the world as to the processes by which the manufacture of bar iron and of its uses was to be attained. The specification of the second patent discloses the process of "puddling" precisely as now practised. And it will be observed here also that reverberatory and air furnaces, and rollers, and working instruments are treated and spoken of as things well known ; the invention in respect of these consisting in their adaptation and manner of application. It should also be observed that the improved blast or application of improved blowing machinery was wholly immaterial to Cort's invention, which required only the ordinary reverberatory or air furnace.

Cort, at the conclusion of his specification in the passage already cited, declares his practice to be "entirely new, and contrary to all received opinions amongst persons conversant in the manufacture of iron." That he should have to encounter detraction, disbelief, and opposition is the inheritance of such men ; fortunately, however, his position in society, and the means in his control, enabled him to demonstrate beyond cavil the truth of his representations as to the improvements resulting from his combined processes in the manufacture of iron.

THE SEWING MACHINE.

ITS VALUE.

No. III.

FEW persons in Great Britain are aware of the immense value of the sewing machine trade either to those who use machines, to those who own them, to those who manufacture them, or to the public in general.

The running of a sewing machine is a remarkably healthful and pleasant employment. The erect attitude of the operator, the exercise of the lower limbs in giving it motion, its lively clicking, and the rapidity with which "band and gusset and seam" are sewn up—all tend to keep up the spirits and preserve the health. The hours of labour, too, are short. In this country operators work on an average only nine or ten hours a day. One firm in New York which employs about 200 machines and 400 young women, says: "The fatigue is so slight that our *employés* work the year round and continue in good health and spirits." An American lady, accustomed to use a machine in her family, writes: "My sewing machine is to me perfectly fascinating. My children leave their amusements for the sake of operating it. The laundress and the waiting-maid hurry through their duties to share that of the sempstress. Housekeepers may well exchange their pianos, which they never have time to use, for a machine which will relieve them of many hours of weary labour. Substituting, as it does, healthful exercise, and cheerful, rational employment for the soul-and-body destroying drudgery of hand-sewing, it should be hailed as '*Woman's Friend.*'"

Its introduction has tended to raise women's wages. In the United States the wages of operators range from 12s. to 33s. per week. In New York a woman has been known to make as high as £12 per week with two assistants to prepare and finish the work. In Great Britain the wages of operators range from 7s. to 30s. per week, (the average being probably about 12s. per week), "whereas a mere sempstress can hardly earn half this sum, and that, too, through long protracted, labour." In the stay-trade, the stay-stitchers who did the cheapest kind of work could only obtain an average of 1s. 6d. or 2s. a week, but by the use of a sewing machine they can now earn from 7s. to 9s. a week.

But while the sewing machine has doubled the wages of one class of operatives, it has not perceptibly lessened the number of persons engaged in tailoring, bootmaking, shirtmaking, dressmaking, and similar trades. "It may tend to displace a portion of male labour, but at the same time it calls into existence female labour, and that, too, at an enhanced value."* More work is put upon clothing now than before the use of machinery. Even on the coarser garments worn by the middle and poorer classes there is or amental work, such as double instead of single stitching on shirts, and on the breasts and sleeves of coats. Besides, the lessened cost of production has greatly increased

* See Dr. Strang's Paper on "The Sewing Machine in Glasgow," read before the British Association, at Leeds, September 25, 1858.

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the demand for ready-made clothing both for home consumption and for exportation to all parts of the world. The necessary consequence of this increasing demand for well-made clothing has been an increasing demand for female labour. Poor women now get better pay for lighter work than they did a few years ago, when Hood drew the sympathies of the world to the needlewomen of London by his inimitable "Song of the Shirt." At present the demand for sewing machine operators exceeds the supply, and with the farther extension of the use of machines we may naturally expect increased employment for females and an increase of their wages.

The amount of sewing done by a single machine in a day or week necessarily varies with the expertness of the operator, the kind of machine used, and the quality of the work to be done. With a good operator on a first-class machine, one thousand yards of straight seam, ten stitches to the inch, is said to be an ordinary day's work of ten hours. Ten dozen of shirt wristbands can be made in an hour. Fifty dozen collars, or eighty shirt bosoms with seven rows of stitching, are easily made in one day. Eight fine linen coats may be made in a day of ten hours, and thirty such coats are an average week's work for one machine.

This rapidity of production has, hitherto, served to increase the profits of the wealthy manufacturers who own machines rather than to reduce the price of the manufactured article. Almost all those persons who were so rich and so fortunate as to purchase machines two or three years ago have been gaining a profit of from 20 to 25 per cent. more than their competitors who were content to plod on in the old methods of doing business. In some kinds of goods, however, the sewing machine *has* reduced the price of the finished article. In New York the price of men's clothing and of ladies' gaiter boots has been reduced about 20 per cent. It is said that in London, bootmakers can buy machine-made boot tops 30 per cent. cheaper than those made by hand. The finished boots, however, have not fallen in price more than from 10 to 15 per cent. But not until the reduction in the cost of manufacturing has been followed by a corresponding reduction in the prices of the finished articles in every department of trade will the full value and importance of the sewing machine be sensibly felt by the whole community.

The profits of those who use machines cannot, however, be so large as the profits of those who make them. It is believed by many persons in America that the three firms who have monopolized almost the whole business in the United States have become so wealthy that they are able to control the Patent Office. The existence of this belief (although it must be unfounded) is the best evidence of the enormous profits made by American manufacturers. We have no means of obtaining information regarding the profits of manufacturing in England. Machinists, judging merely from the appearance of the finished machine, say that on machines sold from £20 to £30 the manufacturer's profit cannot amount to less than three-fifths of the selling prices; that is, on a machine sold for £25 the manufacturer has a clear profit of £15.

But while the profits of some of the patentees both in this country and the United States have been enormous, the public have gained largely from the use of their inventions. A single sewing machine in the least advantageous work is equal to the labour of six persons, and in many kinds of work, especially the finer and more difficult kinds of work, it is equal to the labour of from fifteen to twenty persons. Making every allowance, therefore, for the time machines are out of order, we may safely estimate that, on an average, every machine in Great Britain does as much as seven hand sewers. The 10,000 machines now at work in the country have added as much to its wealth as the labour of 60,000 persons beyond those actually employed would have added in the same time. And supposing these machines have been in use for only two years, they have already increased the national wealth by one million and a half. During the same period, sewing machines must have added not less than fifteen millions to the wealth of the United States.

MONEY-MAKING AT THE ROYAL MINT.

No. VI.

IT will be remembered that in our last week's paper on this interesting subject, the coining press-room was spoken of, and the rapid manner in which the conversion of prepared blanks of metal, whether of gold, silver, or copper, into sterling coin, under the force of the screw presses, drew forth its meed of commendation. There were allusions made also to the vacuum-chamber, by the aid of which the direct motion is given to those presses; and of this it will be perhaps well to give a little further explanation before advancing to the process of medal striking, and the manufacture of dies.

The vacuum-chamber was spoken of as an iron tube of considerable dimensions, and its use explained, but it was not stated by what means the vacuum in it was got up and maintained.* When Boulton and Watt in 1810 fitted up this portion of the Mint they had determined by actual experiment at Soho that the pressure of the atmosphere was the best possible power to use for stamping money, and they had accordingly devised what was called *secret* machinery on that principle for the Royal establishment. They, however, had calculated that for the effective working of the eight presses ordered for Tower-hill a ten-horse steam engine with two powerful air-pumps would be necessary. These were supplied, and the air-pumps, on the butterfly valve principle, 24 inches in diameter, and with a 28 inch stroke, worked from either end of a pump beam driven by a crank on the end of the fly-wheel shaft of the engine, were employed for a number of years—up to 1852, indeed—in exhausting the vacuum-chamber.

Things might have gone on in this primitive and very expensive manner up to this hour had not a very remarkable improvement been suggested in 1851 by a young mechanic, who had a few years previously been transplanted from the establishment of the Messrs. Rennie. This gentleman, whose name ought to be better known at the Treasury, conceived that if instead of using the one steam engine and the two pumps of Boulton and Watt for the exhaustive process, he were to attach to the beam of a 20-horse power engine, by Rennie—lately erected at a distance of some 220 or 230 feet from the press-room, and used for pumping water from an artesian well of great depth—a double acting air pump, and then carry a tube to connect it with the vacuum-chamber over the roof of the coining department, he might accomplish the same object at a vastly diminished expense. The proposition obtained little attention, although laid before the Sheil-Hume commission, until the advent of Captain Harness, R.E., who at once saw the practicability and value of the plan. In the beginning of the year 1853 the inventor of the new arrangement had the satisfaction of seeing it adopted, manufactured by Rennie, and put to practical use. It was found vastly superior in every respect to the old system. The extent of the vacuum gained by the well-constructed pump—which was of large comparative area and of short stroke, and which of course exhausted in the up and the down stroke—was much higher than could be obtained by the ancient "butterflies." The power obtained, too, was more steady and uniform, whilst the saving effected amounted to something like £200 per annum in fuel and wages—a saving still going on. Another great advantage which it gave to the Mint was, that it answered the purpose of a duplicate steam-engine. If the new pump became deranged, the old butterflies would be resorted to, and if the latter broke down there was the new arrangement in reserve.

This very neat plan of transferring so much of the power of the pumping-engine as is needed over the building and among the chimney-pots, to the presses, without the aid of shafting or gearing or any apparatus susceptible of disarrangement, is a thing of which, as the author, the foremen of the coining press-room may very legitimately feel proud. The pockets of his fellow-countrymen have been spared to some extent by its introduction, if his own have derived no benefit therefrom. The extent to which the vacuum may be raised by the double-acting coining-pump is regulated by a steelyard relief valve placed on a branch of the vacuum-chamber, and a barometer gauge near it. If medals are in process of manipulation the vacuum is at its maximum point; if quarter-farthings, or *obolis*, then at its minimum. But every coin which has issued from the Mint for the last forty-nine years—and a great majority of the medals also—owe their sharp, clear, and beautiful impressions to the weight of the atmosphere. The air we breathe has, in short, coined all the money we use.

In touching upon this theme, it may be mentioned that a branch from the main artery for the circulation of air—the suction pipe to the vacuum-chamber—a branch from this descends to the vacuum-chamber of the weighing-room atmospheric engine, and thus creates the steady, never-changing motion which is given to the valuable weighing machines of which we have spoken.

It will be now completely understood that the *vacuum-chamber* is an important adjunct to the screw-presses; and, as the latter were left in our last chapter delivering themselves of finished coins at the rate, if all were in action, of 200,000 per diem, we may return to them after this dissertation on air. "Trifles light as air" have been alluded to by our never-to-be-forgotten bard; but, if he had known as much of the weight of that ethereal substance as the Queen's coiners, he would doubtless have substituted another simile. The gold pieces of the four bags have been followed by many, many more, and there, ranged in the butcher's trays without handles, are thousands and thousands of the metallic portraits of Her Majesty. These are, at the close of the day, placed on trucks, conveyed once again to the scales, weighed up carefully, folded once again in the little journey bags of 180oz., placed, in batches of eight bags or 5,608 sovereigns, in the trays, put into *omnibus* trucks, deposited in the stronghold, and locked. "Thanks!" says the officer, in turning the key upon perhaps 300,000 or 400,000—"thanks be to Providence, the wearing anxieties and cares of the day are over! Thanks, for losing sight of gold."

On the following morning at eleven, it is likely that a visitor to the Mint would see issuing into the "quadrilateral," or rather the quadrangular space, one or perhaps two of the omnibus trucks evidently bearing heavy burdens, and requiring each three or four men to propel them. They each contain, in fact, 70,100 sovereigns, weighing 18,003·06 ozs., and are destined to pass in—in very different form, shape, and value to that in which when bound for the melting-house they left it—to the central office. Arrived per tramway before alluded to, they are now "pyxed" by the senior officers. The pyxing is an operation into which we need at present perhaps not go into minute detail. It is a very ancient custom. Briefly, it may be said that a coin is reserved from each bag of gold—and the same may be said of silver—and placed in the pix, meaning a casket or chest. This latter, after the whole of the bags have had one coin abstracted from each and another to make the journey weights correct, is sealed with three seals and secured with three locks. The Master of the Mint holds one of these, the Chancellor of the Exchequer another, and the Queen's Assayer the third. The pieces of gold or silver so carefully preserved are kept till the trial of the pix, an annual performance—something after the sheriff's hob-nail arithmetic feat in usefulness—at which the fineness of the metal, as compared with certain trial plates kept in the treasury of the chapel of Edward the Confessor, in the cloisters of Westminster Abbey, is enquired into and a dinner partaken of. The pyxing at the Mint is a short operation, and after it the coins are ready

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for delivery to the Bank. Bank clerks now arrive to check the journey weights in weighing with the Mint clerks. Bank porters come to put them into Bank chests, which are deposited in licensed carriers' carts, and fair receipt being given, the horses are compelled to move on, and away up the Minories, *en route* for the Bank itself, go the finished sovereigns. May those £140,000 which have just now gone, without any guard save a porter or two, be the means of doing an amount of unalloyed good, and may none of them be ever used for base purposes!

Returning once again to the coining department, we find that a change has come over the spirit of its dream. What are those large heavy discs of white metal—are they for crown pieces? No! they are intended for medals. They have been so far prepared in the same way that metal is prepared for stamping. They are of fine or virgin silver—that is, silver unalloyed—and have been rolled down from bars of the florin size—as given in Art. No. II. They have been also cut in the way explained with regard to ordinary coin. Now the treatment must, however, be different, and briefly that treatment shall be defined. The cut work is brought to the annealing-room in bags of 1000 medal blanks each. These are counted. They are next placed in open wrought iron pans and annealed or baked, then blanched, and now being distributed over recessed boards, their faces are scrubbed by means of scrubbing brushes, and with silver sand—the finest sand, that is—and water. This gives bright surfaces to them. Next they are dried by aid of box-wood sawdust, sieves, and drying stoves. And now they are ready to receive first impressions—in some cases very lasting as 'tis said—but in this of not half the value of past ones.

Removed to the press-room, counted, and supplied to a press tender, *rouleaux* are placed in a tube *à l'ordinaire*, the press is set in motion, the feeder does its duties, the dies kiss the pieces on both cheeks, the collar rises and falls, they are delivered into trays, examined by the press-room critics, and the whole operation resembles coining very much. But, alas! examine the embryo medals. They are not half struck. They may be intended for Crimean medals, but as yet there are but shadows of victory, and the well-known Roman warrior to be seen on the reverse, the noble head of the Queen is but outlined, and there are no letters. Evidently this is a preparatory step only? True; they have to be returned to the annealing-room, again baked, again blanched, again scrubbed, and again dried. Striking medals is a different and far more expensive process than coining money. The shadowy medals are again prepared and returned to the press-room once more. This time they must be daintily touched by the operator or they will be soiled, and perhaps require to go through all the stages again. Placed singly on a warm iron plate beside the press, to which one die only—the lower one—beautifully polished is attached, the operator takes them one by one, and puts them with his fingers on that die, taking especial care that the partly raised impression falls exactly into the corresponding cavities of the finishing die. He now places by hand also a steel collar of the size of the finished medal over the piece of silver—so as to encompass it—the collar being polished as the dies on its circumference. Next he "feels" the upper die upon the disc of silver, and makes its partially raised surface fit it. He now pulls one line, it closes the outer valve—another, it opens the inner one—of the press-pump. The screw with a plain block of steel fastened below its point has descended with terrific force upon the upper die, and the silver has suffered great compression. The press has rebounded, and is at rest. The upper die is taken off, the medal fitting the collar tightly, by force of pressure is lifted with the collar from the lower die, and behold you it is, as far as the Mint deals with it, perfect. It is pressed from the collar, examined by aid of a glass, and it is found that the soft silver with that last heavy blow has been forced into every interstice of the elaborately-engraved die. It has become an exquisite work of art, and it requires but the clip, the clasp, the riband, and the name to make it worthy the acceptance of the bravest soldier.

INSTITUTION OF CIVIL ENGINEERS.

PREMIUMS, SESSION 1858-59.

THE Council of the Institution of Civil Engineers have awarded the following premiums for papers read during the session recently concluded:—

1. A Telford Medal, to Michael Scott, M. Inst. C.E., for his paper "Description of a Breakwater at the Port of Blyth, and of Improvements in Breakwaters, applicable to Harbours of Refuge."

2. A Telford Medal, to Robert Mallet, M. Inst. C.E., for his paper "On the Co efficients of Elasticity and of Rupture in Wrought Iron, in relation to the volume of the Metallic Mass, its metallurgic treatment, and the axial direction of its constituent crystals."

3. A Telford Medal, to Henry Bessemer, for his paper "On the Manufacture of Malleable Iron and Steel."

4. A Telford Medal and the Manby Premium, in Books, to William Joseph Kingsbury, Assoc. Inst. C.E., for his paper "Description of the Entrance, Entrance Lock, and Jetty Walls of the Victoria (London) Docks; with Remarks on the Form adopted in the construction of the Wrought Iron Gates and Caisson."

5. A Watt Medal, to James Wardrop Jameson, Assoc. Inst. C.E., for his paper "On the performances of the screw steam-ship Sahel, fitted with Du Trembley's Combined Vapour Engine, and of the sister ship Oasis, with steam-engines worked expansively, and provided with partial surface condensation."

6. A Council Premium of Books to Thomas Sebastain Isaac for his paper "On the Successful Working, by Locomotive Power, over gradients of 1 in 17, and curves of 300 feet radius, on Inclines in America."

7. A Council Premium of Books to Matthew Bullock Jackson, M. Inst. C.E., for his paper "Description of the Gravitation Water Works at Melbourne, South Australia."

ROYAL AGRICULTURAL SOCIETY'S MEETING.

WARWICK, Wednesday.

THE following prizes for implements have been awarded:—

Judges: Messrs. W. Owen, C.E.; Jno. Brasnett, J. Clarke, J. Druce, J. Hicken, G. M. Hipwell, J. J. Rowley, J. Thompson, W. Tindal; C. E. Amos, C.E., consulting engineer. Stewards: Messrs. Barnett, Caldwell, and Pope.

Prizes: £4, Hornsby and Sons, light land plough; £3, Ransomes and Sims, ditto; £2, J. and F. Howard, ditto; £1, Hensman and Son, ditto; £2, John Eddy, turnwrest plough; £6, J. and F. Howard, general purpose plough; £5, Hornsby and Sons, ditto; £4, Ransomes and Sims, ditto; £2, Busby Agricultural Implement Company, ditto; £1, Hensman and Son, ditto; £3, Hornsby and Sons, heavy landplough; £2, J. and F. Howard, ditto; £2, Ransomes and Sims, ditto; £1 10s., W. Ball, ditto; £1 10s., Busby Agricultural Implement Company, ditto; £4, Messrs. J. and F. Howard, harrows for light land; £3, ditto ditto; £2, Messrs. Page and Co., ditto; £2, Messrs. Mapplebeck and Lowe, chain harrows; £4, Messrs. J. and F. Howard, harrows for heavy land; £3, Messrs. Page and Co., ditto; £2, Messrs. Ransomes and Sims, ditto; £5, Mr. Bentall, cultivator for light land; £3, Messrs. Coleman and Son, ditto; £2, Mr. Cray, ditto; £5, Messrs. Coleman and Son, cultivators for heavy land; £3, Mr. Bentall, ditto; £2, Messrs. Ransomes and Sims, ditto; £3, Thomas Scragg, hand-power tile machine; £2, J. Whitehead, hand tile machine; £15, A. and W. Endington, draining plough and windlass; £3, F. Parkes and Co., bundle draining tools; £2, Mapplebeck and Love, bundle draining tools; £10, J. Whitehead, brick and tile machine; £5, H. Chamberlain, brick and tile machine; £50, John Fowler, jun., set of steam cultivating apparatus, and balance four-furrow plough; £5, Trustees of Wm. Crosskill, field roller; £3, Messrs. Hill and Smith, field roller; £2, ditto, ditto; £5, Messrs. A. and E. Crosskill, clod crusher; £3, W. Cambridge, ditto; £2, Trustees of Wm. Crosskill, ditto.

Silver Medals.—Sidney Flavel and Co., kitchen range; Thomas Gibbs and Co., collection of agricultural plants, seeds, and grain, in great variety; Peter Lawson and Son, collection of plants, seeds, and grain; W. H. and George Dawes, patent atmospheric hammer; Humphrey Chamberlain, dry clay brick-making machine; Humphrey Chamberlain, plastic clay brick-making machine; Burgess and Key, grass-mowing machine.

Law Case.

COURT OF CHANCERY, Lincoln's-inn, July 8.—(*Before Vice-Chancellor Sir W. P. Wood.*)

THE PATENT TYPE-FOUNDING COMPANY (LIMITED) *v.* RICHARD.

This was a demurrer. The bill was filed to restrain the infringement of a patent for "improvements in the manufacture of type and other raised surfaces for printing," which had become vested in the plaintiffs by assignment from John Robert Johnson, the original patentee. The patent was granted in 1854, and the specification contained the following statements:—"In the manufacture of type and other raised surfaces for printing it has been usual for the most part to employ compounds of lead and antimony as the metal for casting the same, and in some cases a small percentage of tin has been added. Now, the object of my invention is to obtain harder, tougher, and more enduring type, and by employing tin in large proportions with antimony, and to greatly reduce or wholly omit the use of lead with such metals when making type, by which means the type produced is so hard, tough, and enduring as to allow of its being used as a punch on the ordinary type metal now used, and the best proportions I am acquainted with are 75 of tin and 25 of antimony, but this may be to some extent varied; and when lead is also used I find that it must not exceed 50 parts in 100 of the combined metals employed, for if the lead be employed in much larger quantity the hardness and toughness of the alloy rapidly decrease, and the alloy then approaches the ordinary type metal in its properties, notwithstanding the presence of a considerable quantity of tin. When the antimony is tolerably pure, the best proportions are as given above—one part of antimony to three of tin or tin and lead; but when it contains other metals I find that the quantity of antimony should be diminished, or which is preferable, the metal should be repurified. If this be not attended to, the alloy, though of great hardness, does not possess the tenacity or hardness necessary for type of extreme durability."

The defendants, against whom a case of having infringed the patent was alleged in the bill, had put in a demurrer, on the ground that the specification as set out in the bill was so vague as to render the patent void, and, at all events, to deprive the plaintiffs of any title to relief upon it in equity.

Sir Hugh Cairns, Mr. Webster (of the common law bar), and Mr. Druce appeared in support of the demurrer; Mr. Rolt and Mr. Bowring (with whom was Mr. Hindmarch, of the common law bar) were for the plaintiffs.

The VICE-CHANCELLOR said that the question was whether the specification was so clearly and manifestly bad that it would not enable workmen to carry it into execution. The invention appeared to be definitely stated, assuming that something further might come out in evidence. Was there any vagueness because the specification stated that the precise proportions might be varied? Upon a patent depending upon proportions the patentee was not bound to limit his claim entirely to those proportions. The vital property of the patent was a large proportion of tin, as contrasted with antimony, and, though some slight variation might be made in the proportions, yet that would not avoid the patent. Evidence might be produced as to the validity or invalidity of the patent before a jury, but at all events the patent, as stated on the face of the bill, was not void for indefiniteness. The demurrer must therefore be overruled.

Sir HUGH CAIRNS obtained leave to file a plea at once, leave being requested (after putting in a demurrer) for resorting to this mode of defence, which is technically known as a "second dilatory."

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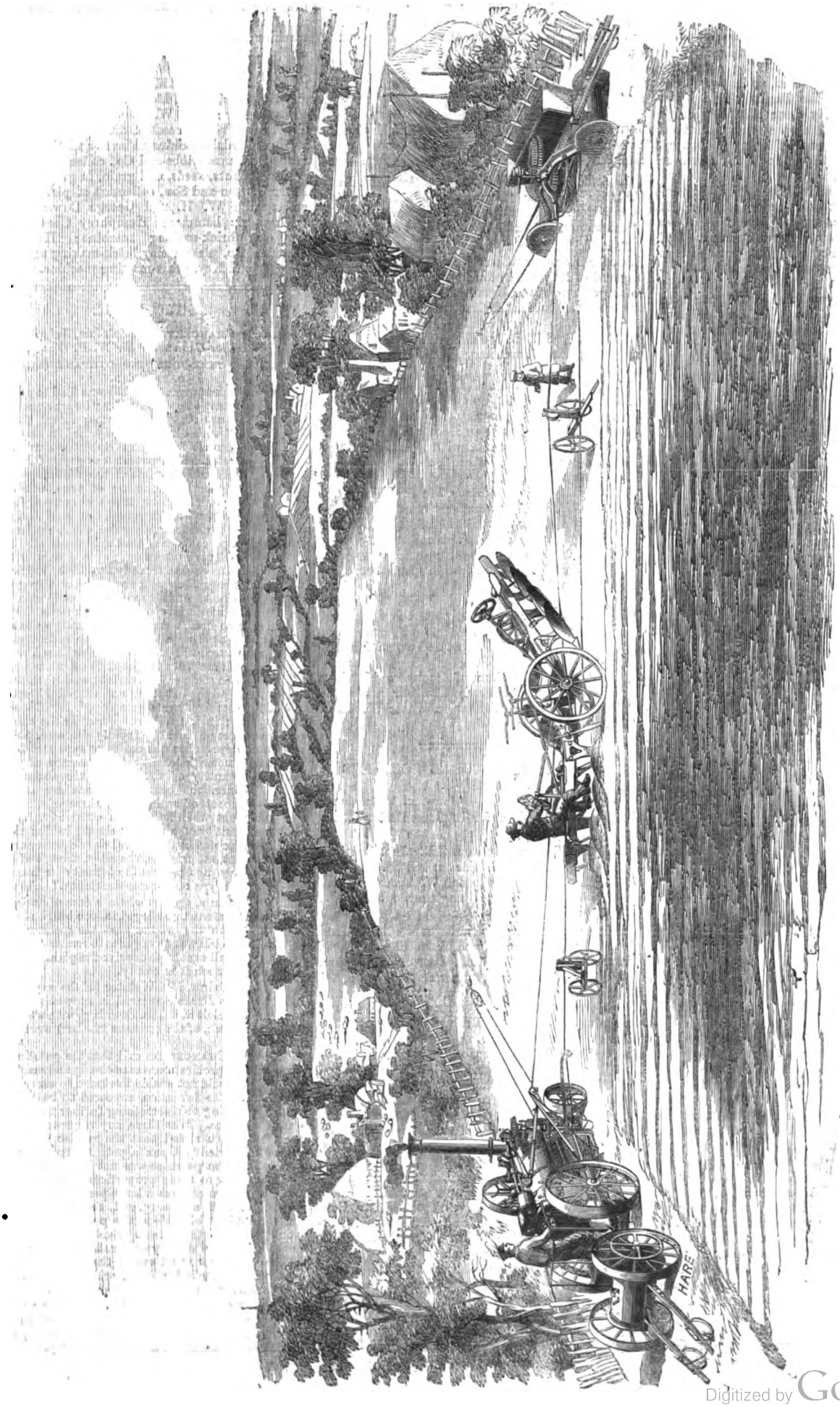

FOWLER'S STEAM PLOUGHING APPARATUS.

PLAN OF WORKING.—On the left headland is the Engine and Windlass, the Water-cart, and directly opposite to them the Anchor, and between these two the Plough is pulled backwards and forwards, one end of the Plough being alternately in the air and the other in its work.

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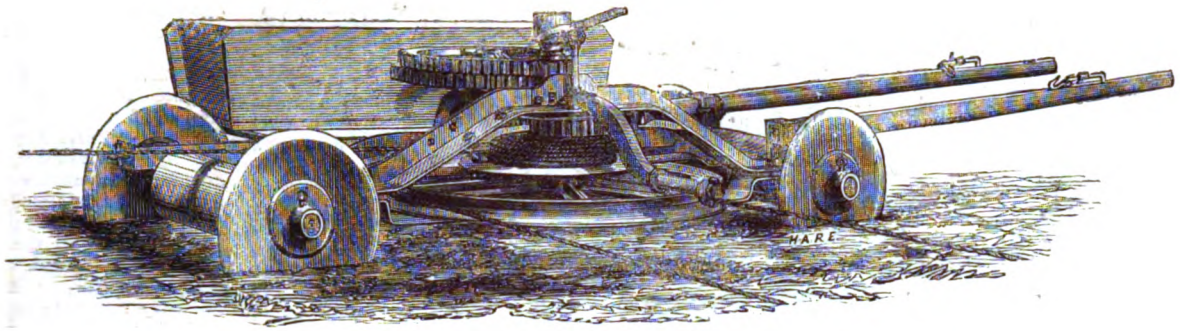
FOWLER'S STEAM PLOUGHING APPARATUS.

FIG. I.—SELF-MOVING ANCHOR.



A FEW weeks ago we gave a description and illustrations of the main portions of Mr. J. Fowler's apparatus for ploughing land by steam power, noticing the successive improvements he has made in it from the time he first exhibited it, and the very great degree of simplification he has at present attained in its construction. These improvements may be shortly stated to consist, first, of a better mode of applying the power; secondly, the lightening and cheapening of the apparatus; and, thirdly, the improvements made in its details, which cannot be separately enumerated, but which, taken collectively, are of vital importance, as upon the mode of carrying them out depend its durability and efficiency. The difference between good and bad detail frequently constitute all the difference between a machine made only to be looked at, and one which will bear to be daily worked. The great success of Mr. Fowler's apparatus at the trials which have been made during the present week at Warwick, induce us now to give yet a fuller description of it in its present form.

The first improvement—viz., that in the mode of applying the power, is one of very great importance. Instead of laying a rope *round* the field, as was done at Chelmsford in 1856, the engine and windlass are now made to work themselves along one side of the field as the plough performs its work, the anchor doing the same at the opposite side, as shown in the accompanying large illustration, the plough being worked between the engine and the anchor. Again, the rope being now passed over two grooves, instead of being wound on a barrel, as formerly, is another step of much importance, especially as it saves a considerable length of rope. Next, the adoption of steel instead of iron rope has effected a great saving in wear and tear, which saving is further increased by passing it round large (4 feet) pulleys instead of small ones as formerly. As we have already explained in our last article, the windlass is now permanently combined with the engine, which, by aid of pitch wheels and chain, is made capable of moving itself by steam from field to field, only requiring to be steered by one or two horses, which is easily done, and avoids much of the complication attending ordinary steering apparatus.

FIG. 2.—WATER CART.

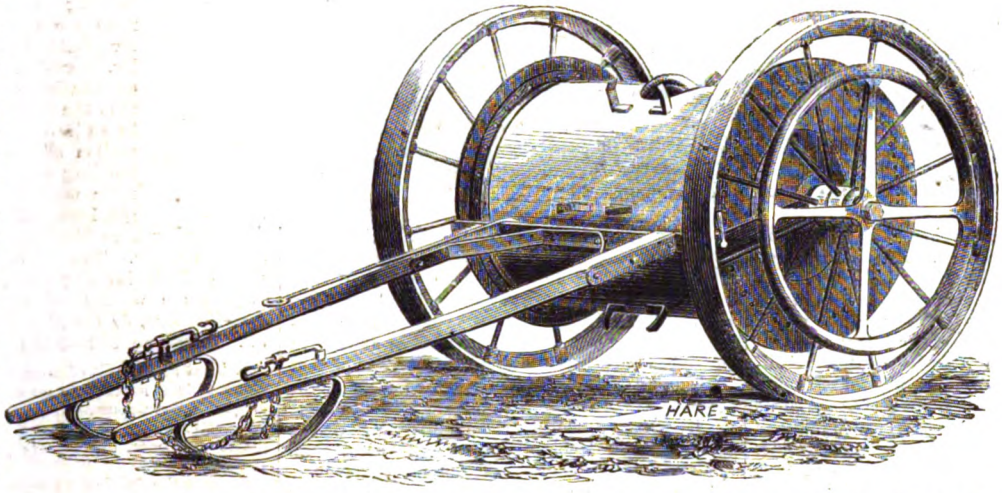
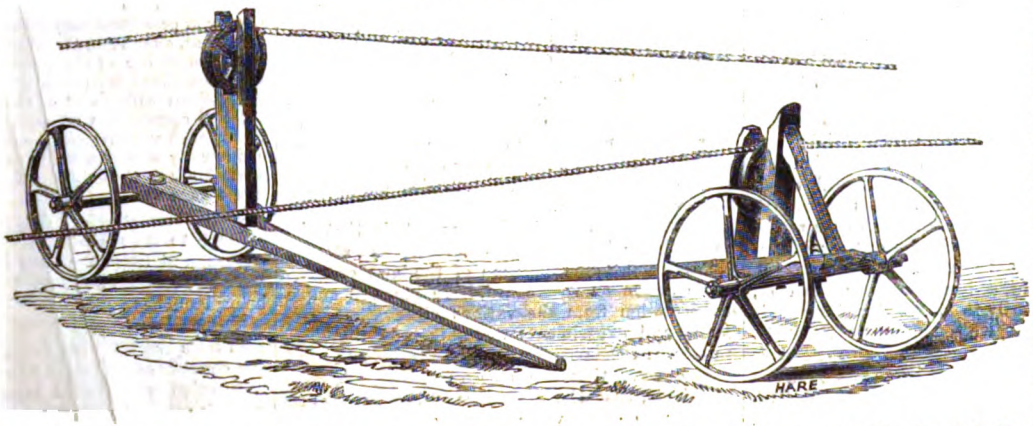


FIG. 3.—ROPE PORTER.



In our former article we gave an illustration of an anchor used for some time by Mr. Fowler; but, as was then stated, not one of the most recent construction. We are now enabled to give an illustration of the latter, which is shown in Fig. 1. The frame is made entirely of wrought iron, the winding-forward drum being placed upon an upright spindle; and the machine so constructed with shafts as to be capable of being worked round any ordinary bend in a hedge. The side strain is well borne by the cutting discs or wheels fitted to the machine, which is balanced by having a box filled with earth fixed at the side opposite that from which the wire-rope passes off. The forward motion is accomplished by the friction of the wire-rope on the four-feet pulley, to which is attached a drum for winding up a rope stretched along the headland and fixed to the ground.

The water-cart, which is drawn along with the engine, is made circular, and of wrought-iron, and is shown in Fig. 2. It is used also for conveying the wire rope from place to place, and for this purpose is fitted with a fly-wheel and handle for winding the rope up upon it. The cart is made to contain about 150 gallons of water. Fig. 3 shows two of the rope "porters," with the rope running over the pullies, as it does when in use. Several of these porters are used when the field to be ploughed is of great length, in order to keep the rope as much off the ground as possible, thus to prevent unnecessary wear, and to economise the power required to work the apparatus.

We have before illustrated Mr. Fowler's balance-plough, but the accompanying illustration, Fig. 4, shows the application of scarifier irons to the same frame work, the plough bodies being removed. Instead of attaching scarifier irons, the breasts only may be removed and shut, and blunt mould boards

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FIG. 4.—SCARIFIER PLOUGH.

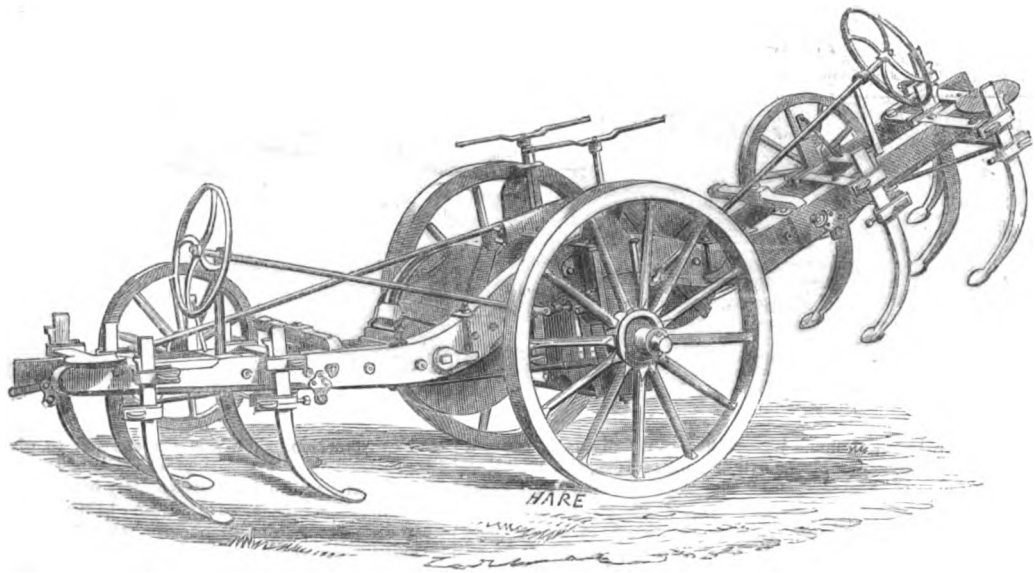
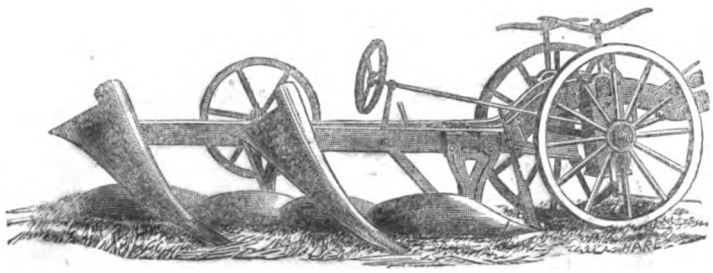


FIG. 5.—TRENCHING PLOUGH.



substituted in their steads, when at one operation a perfect fallow may be made. Fig. 5 shows one-half of a balance plough frame, with subsoil irons attached. We have now given illustrations of the whole apparatus used by Mr. Fowler, and which may be seen in operation at the Royal Agricultural Society's Show at Warwick, where agriculturists will have had an opportunity of verifying the statements we have made with regard to its simplicity and efficiency. The cost of ploughing by steam was stated in our last article, the results given being from trials by the Society's engineer. Estimates have, however, been made by several persons, and the several conclusions arrived at are that from 7s. to 10s. may be fairly put down as the cost of steam ploughing for different classes of land, and from 9s. to 18s. for double trenching the soil. These accounts, be it remembered, include every expense, wear and tear, interest of capital, &c., and compare very favourably with home labour. We insist that after so persevering a course as that which Mr. Fowler has taken, he should at length reap the reward of his labours. They have been most arduous, very costly, and such as nothing but a firm conviction that success was attainable, and a determination to obtain it, would have enabled him to overcome.

BOAT-LOWERING APPARATUS.—Mr. Clifford has forwarded to us—but too late for publication this week—a reply to the letter of "Nauticus," which appeared in our last impression. This we hope to insert in our next, but in the mean time as the letter of "Nauticus" contained a statement relative to an accident to a boat's crew of the Oracle, which, if not immediately replied to, might operate seriously to Mr. Clifford's injury, it is only right that we should state that Mr. Clifford produces in contradiction to the charge letters from Messrs. Green and the Captain, which affirm "*that there was not the slightest blame attached to her lowering gear*," and furthermore, "that where it has been fitted in Messrs. Green's ships it has given general satisfaction."

THE MAGNETISM OF SHIPS.

By F. J. EVANS, Esq., Master R.N., F.R.A.S., Superintendent of the Compass Department, Admiralty.*

I HAVE to bring to your notice, and under review, the valuable labours, still in progress, of a committee formed at Liverpool by various gentlemen connected with the vast shipping interests of that port, and working also under the auspices of the Board of Trade, to collect observations and make experiments on the condition and distribution of magnetism in iron-built ships, and the general system of compass correction and management.

Two or three disastrous shipwrecks, clearly traced to compass errors, occurring about the time that the iron navy of Liverpool was rapidly expanding, gave rise to various conflicting opinions on the safety of their navigation, and particularly on the subject of compass-compensation by magnets; these questions were discussed in various periodicals, and also at the British Association for the Advancement of Science, held at Liverpool in 1854: hence arose the formation of the Liverpool Compass Committee.

The publication in 1857 of the first and second reports of that body to the Board of Trade, and presented to both Houses of Parliament by command of Her Majesty, enables the observations relative to the theory of the magnetism of ships to be extended, not only in confirming what has been already advanced, but in giving some more general views of its character and distribution, particularly in iron-built vessels.

A striking feature in these reports is, that the researches of the various authorities already quoted, and their exposition of the laws of magnetic action on ship-board, have received ample confirmation from the various observations collected and experiments undertaken by the committee. In the opening page of the second report they observe, that it has been "proved, too, most decisively, that the deviations of the compass on board iron ships, when properly ascertained, are not of that irregular and erratic character which many cards of deviation might lead one to suppose, but that they accord most closely with the deductions of theory and experiment, as exemplified in the works of the Astronomer Royal and Mr. Archibald Smith." And again, at p. 24, in alluding to certain fluctuations in the amount and direction of a ship's induced magnetism, — "These fluctuations do not appear, however, to affect *practically* an authoritative statement which has already been supported by the committee, and which, as it forms the key to the correction and calculation of compass deviations, cannot be too earnestly repeated; namely, that a ship's magnetism for any given place may be very closely represented by a permanent polar magnetic force in combination with a quadrantal force, or one changing its deviation in each quadrant as a ship is swung round."

Among the various philosophers who, during the present half century —a period noted for the progress of theoretical and experimental research—have grappled with the perplexing and, it may be said, uninviting science of magnetism, none more perseveringly worked for practical ends than the late Rev. Dr. Scoresby, and to him is due the enunciation of the notable facts, that the distribution of magnetism in an iron ship depends on the direction of the keel and head while building with reference to the magnetic meridian; and that this original magnetism is subject to great changes after launching, and also from other extraneous causes. The following from among the results of his investigations, as bearing on the subject, are worthy of extract. — (*Magnetical Investigations, by the Rev.* WM. SCORESBY, D.D., vol. ii. 1852, pp. 330—343.)

1. That ships built of iron in place of timber and plank obtain necessarily *an extremely high degree* of magnetic development from the elaborate system of percussive action, as well as from the bending of the plates and bars, during the progress of their construction.

2. That the dominant magnetism thus developed is of the *retentive quality*, a quality remaining whilst terrestrially sustained by consistency of position, and otherwise, also, in relations inaccordant with terrestrial influence, whilst the ship remains free from mechanical violence or other magnetically-disturbing force.

3. That in each iron ship there is a special individuality of the magnetic distribution, depending *essentially* on the position—characterised by the direction of the keel and head—whilst building, and *peculiarly* on the deviations from uniformity in the placing of occasional heavy masses of iron.

4. That, after being launched, percussion, vibration, or the straining of the general frame of iron-built ships, must *tend* to equalise the relations of the ship's magnetisms with those of the earth; and that the state of equalisation or approximation thereto will be hastened and advanced accordingly as the quantity or intensity of mechanical violence is increased, and accordingly as the ship's head is kept pretty steadily in the same direction.

The accompanying diagrams represent, according to Dr. Scoresby, the theoretic magnetic condition of iron ships built in England, with the dip of the needle from 68° to 70° N., previous to being launched.

The confirmation of Dr. Scoresby's views will be seen from the following extract: "The records of the committee no longer allow a doubt as to the connection which exists between the direction of a ship's original magnetism and her position when upon the building slip. In all the ships which have been examined, the north end of the compass-needle invariably deviated towards that part

* Portion of a paper recently read at the United Service Institution, and published in the Journal of that Society.

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of the ship which was farthest from the north while she was building, if the compass was placed in a central position, and free from the influence of individual masses of iron."*

The reports also further proceed to show that the characteristic features of the original magnetism of an iron ship, by which is meant the magnetism dependent on her direction when building, and the effect on a compass when she is swung, presuming that the needle is not influenced by iron bulk-heads, or proximity to the stern-post, rudder-head, or other masses of vertical iron controlling the magnetism of the hull of the ship, is as follows:—

In an iron ship built with her head to the north, or nearly so, there is no apparent attraction of the needle towards either side while she lies in a north or south direction: but with her head in all other directions there is a strong attraction towards the stern.

With ships built head to the south, the same principle will apply, the deviation being then towards the bow.

When built with head to the east, the deviation is towards the starboard side, (the south in building) and when built with the head to the west, to the port side (the south in building): [this deviation must be considered as only due to a differential action, for if a compass be placed near the top sides of such ships either internally or externally, the north end of the needle (in north magnetic latitudes) is attracted; one side, however, attracts the needle more strongly than the other, and that is the side which was furthest from the north when the ship was building, as above stated.] In these vessels if placed in an east or west direction, the north end of the needle will tend to the bow or stern respectively according to the direction in which lies the greater mass of iron.

In ships built in intermediate positions the preceding characteristics are combined; thus, if built with head to the N.E., the attraction will be aft and to starboard; with the head to the N.W., aft and to port. If the head be S.E. or S.W., the attraction will be forward and to starboard, or forward and to port respectively.

The *amount* of original magnetism appears to have relation to the size of the vessel, or the quantity of iron used in her construction, and is thus illustrated:—"In a ship of 400 tons, built head to east, if a compass be carried fore and aft on the midlle line, about three or four feet from the deck, the deviation may be 10° or 12° when her head is north or south. In a ship of 1,000 tons it may under the same conditions be 25° or 30°, or more, depending to some extent on the breadth of the ship."

From a consideration of the foregoing illustrations, we may at once predicate the character of an iron ship's deviation from a knowledge of the direction of her keel and head when building, or, *vice versâ*, from having her deviation table we may infer the direction in which she was built: the accompanyng table illustrates generally these conditions. This if

Approximate direction of ship's head (magnetic) while building is,	Maximum Easterly deviation when ship's head is near.	Maximum Westerly deviation when ship's head is near.
North.	West.	East.
N.E.	N.W.	S.E.
East.	North.	South.
S.E.	N.E.	S.W.
South.	East.	West.
S.W.	S.E.	N.W.
West.	South.	North.
N.W.	S.W.	N.E.

We have now arrived at an important feature of the inquiry—the ateration in the ship's magnetism after launching—and which would still appear to require an extended series of experiments to elicit more precise information. Numerous examples are given by the committee, but derived more from information communicated than from direct experiment; still there is a notable example deduced from the latter in the case of the ship Royal Charter, which will be hereafter alluded to. The conclusions arrived at are thus given:—

This original magnetism of an iron ship is frequently very permanent as regards direction, but is believed to undergo rapid changes in its amount, both in reality and in its apparent effect on the compass: the most striking change being at and immediately after launching, and during the first voyage. It is usually more evident in a steamer than in a sailing vessel. There are cases in which the deviations in a steamer have changed so much as two points in the first two days at sea, while afterwards the change has not been more than 3° in as many months. In new sailing ships the change is generally, but not always, more gradual, and extends over a longer period. A change of 10° to 15° is not infrequent.

Again, Under some circumstances considerably more than one half of a ship's original magnetism, or rather that part of it which affects the compass, may be lost, or may become balanced in the course of a year.

And, After this early reduction of a ship's magnetism has taken place, the remaining portion, as far as may be judged from examinations made in the same place, and under the same circumstances, appears to be comparatively permanent.

In confirmation of this comparatively permanent condition of a ship's magnetism the committee give a striking example in the case of the ship Great Britain; and it may be permitted me to express my opinion, having had the opportunity of inspecting deviation tables of most of the iron vessels in H.M. navy, extending over many years' observations, that from this evidence also their permanent condition appears to be the rule.

The committee thus report on that well-known iron ship the Great Britain:—

This extraordinary ship has been stranded, and strained, and altered; has traversed both hemispheres, and been very many years in active service: yet her lines of no deviation are now much the same as Dr. Scoresby would indicate them to have been when she was upon the stocks. Yet how small is the change! a proof, apparently, that no circumstances can permanently *conceal* or greatly alter the direction of an iron ship's original magnetism.

[Illustrations in support of these views are given in the Committee Reports of the lines as taken in a graving dock, January, 1856; again in December, 1856, after being for some weeks head N.N.E. in the same graving dock; as they appeared two days after with her head in the opposite direction; and again as determined twice in January, 1857, after undergoing constant hammering in almost every part for forty-three days.]

The most instructive case of the rapid changes of magnetism in a newly-built iron ship is illustrated in the case of the ship Royal Charter, whose deviations were carefully obtained prior to leaving England in January, 1856; at Melbourne in Australia, in May, 1856; and again on her return to Liverpool in August of the same year. These changes are well exemplified by a comparison of the values of the five co-efficients alluded to; the results being selected from an extended series of observations, as made with an Admiralty standard-compass specially placed in aid of the experiments.

	A	B	C	D	E
At Liverpool in Jan. 1856, previous to going on first voyage	−0° 27′,	−3° 48′,	−19° 42′,	+6° 59′,	−0° 52′
At Melbourne in Australia, May, 1856	−1 27,	−1 11,	− 8 59,	+6 23,	−0 26
At Liverpool on return, in Aug. 1856	−0 3,	−1 6,	− 3 22,	+6 10,	+0 56
Liverpool in September, 1856, after alterations	−0 19,	+1 13,	− 8 33,	+6° 0′,	−0 19
Liverpool in October, 1856... ...	−0 9,	−4 55,	−14 0,	+6 41,	−0 9

We see here very distinctly the permanency of the quadrantal deviation as represented principally by the co-efficient D; and the gradual diminution of the sub-permanent magnetism, or polar-magnet deviation, in the co-efficients B and C.

Subsequent experiments in the Royal Charter indicate that the sub-permanent magnetism is approximating to its original amount; but, as some alterations have been made in the ship's fitments, the comparisons are not strictly identical; they are nevertheless well worthy of attention.

Enough has now been advanced to show the valuable nature of the investigations under review, but on the subject of the changes of original magnetism in newly-launched iron ships there appears to be ample scope for further inquiry, both as to the possibility of there being some regular law of change, as also as to the probable time required for the development of its final permanency of character. The alarming change alluded to in the reports by the committee of "cases in which the deviations in a steamer have changed so much as two points in the first two days at sea, while afterwards the change has not been more than 3° in as many months," is from its amount and irregularity sufficient to embarrass the most careful navigator; it is certainly to be hoped that the cases on which the statement is based are exceptional, and arising from the injudicious selection of a position for the compass (probably from close proximity to some ponderous mass, especially of vertical iron). I am certainly disposed to view them in this light from a consideration of the results obtained in the Royal Charter.

An important feature in the navigation of iron vessels, and one at the same time of a perplexing character to the navigator, are the changes of deviation of the compass arising from the heeling of some ships.

In wood-built vessels the errors from this cause may be considered as in general too small in amount to be appreciable in practice, unless the compass is in close proximity to the guns or other masses of iron; but in iron-built vessels the results are not unfrequently of sufficient magnitude to call forth unceasing attention and vigilance. Our information on this head is for the present very incomplete; but some few leading points can be traced, sufficient to place the seaman on his guard and to draw attention to the general characteristics. Messrs. Rundell and Towson, the secretary and honorary secretary to the Liverpool committee, who have paid great attention to the subject, and made various experiments, are of opinion that heeling affects to the greatest extent ships that are built with their heads to the north or the south; and that the effect on the former is to draw the north end of the needle to the weather side, the deviations reaching their maxima when the ship's head is north or south (by compass), and having little or no effect when the ship's head is east or west. In ships built with their head to the south, the north end of the needle will be drawn to the lee side, the maxima and minima deviations observing also the same conditions as those just described.

I propose now to enter somewhat briefly, as I have trespassed long on your attention, on the vexed question of mechanical adjustment for compasses.

Much controversy has taken place on the propriety and indeed safety of applying an antagonistic force to neutralize that of the disturbing effects of the iron in the ship: our highest magnetic authorities differ on the point, though agreeing in the main theoretical principles as to the nature of the magnetic disturbances. The Astronomer Royal is strongly in favour of correcting the deviation of the compass by opposing forces of magnets and soft iron. Admiral FitzRoy, General Sabine, and Mr. A. Smith, supported by numerous nautical authorities, consider such corrections dangerous—except within certain limits, such as coasting navigation—and prefer a superior compass, to be considered a standard, fixed in an elevated position, convenient for careful bearings, as far removed as possible from the disturbing influence of iron, and using the binnacle compass merely as a guide to the man at the wheel.

The opponents of the system of compensation urge that it is defective in principle and dangerous in practice; defective in principle so far that it has not stood the test of experience in distant voyages to the southern hemisphere, and dan-

* This was exemplified by diagrams, which represent the magnetic character of various vessels as determined by actual experiment at Liverpool while they were in dock, and which will appear with the conclusion of this article, probably in our next number.

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gerous inasmuch as it inspires the unskilled and unwary seaman with confidence in the stability of that which is not proved to be stable, and places in his hand a power over the action of the compass-needle which he cannot control and of whose strength he is ignorant.

The advocates, on the other hand, contend that a fertile source of error in navigation arises from the unskilful use of the deviation tables, the corrections being frequently allowed the wrong way, by which the original error is doubled; also that the tables do not provide for changes of the ship's magnetism caused by change of geographic position or other circumstances; and again from the want of directive power of the needles under certain conditions of large deviation due to the ship's iron, combined with the earth's directive or horizontal force being small, as in the higher latitudes; which deficiency of directive power magnet compensation would remedy.

There are just reasons in all or many of these arguments, and the question appears more to resolve itself, as my subsequent remarks will tend to show, into one of application under varied but certain conditions.

(*To be concluded in our next.*)

THE SMALL ARMS FACTORY AT ENFIELD.

THE very complete and extraordinarily interesting machinery of the Small Arms Factory at Enfield Lock has been the theme of eulogium amongst mechanical men for some little time past; and anything in connexion with it cannot but be noteworthy, in these times, to the general public. So perfect are the contrivances there for the purpose in view—the rapid production of small arms of unerring accuracy—that it was thought by some that the force of invention could no further go. Every manipulative process, from the rough branch of the tree and the crude product of the forge, to the finished stock and truly bored and rifled barrel, together with all correlative details pertaining to them, seemed to have been successfully provided for. Machines accomplished almost everything, whilst attendants but looked on, and visitors were amazed.

As it has been often said, however, "Nothing of human creation is *quite* perfect," so it has proved with regard to the machinery of the Small Arms Factory at Enfield. Improvements have been recently, and are now being made in the automaton machines at that place. There appears to be an emulative spirit at work among those engaged near them, which is sure to be productive of advantage, especially as it seems to be encouraged by those in power. There was one portion of the rifle which the manufacturers of Birmingham had pronounced beyond the reach of machine labour at all. This was the lock. Inventions and improvements, however, on the part of some of the foremen of Enfield have brought this important portion of the implement of war quite within machine range; and it is, indeed, completed almost without a touch from the hand of the mechanic. To Mr. C. F. Hayes, Manager of the Lock and Screw Department, belongs mainly the credit of this remarkable, and for the country very economical change; and certainly Col. Dixon, Superintendent of the Establishment, performed but a graceful act when, on Saturday, the 25th ult., he presented Mr. Hayes with a War Department prize of £30 for his ingenuity. The lock of an Enfield rifle is an intricate piece of work; the principal parts being the "bridle," the "swivel," the "tumbler," and the "hammer." It was in relation to these minute but yet consequential details that Mr. Hayes displayed his skill. On the same interesting occasion, we learn that Colonel Dixon, who was attended by J. Gunner, Esq., Inspector of Small Arms, G. Munro, Esq., Storekeeper, and Mr. Barnes, presented second and third prizes of £17 and £13 to Messrs. H. B. Hague and G. Williams, of the "Furniture" and "Sight" Departments respectively, for inventions in connexion with their branches of small arms manipulation.

We record these facts because they are interesting and satisfactory, and because we are anxious that in all cases there should be an appreciation of services rendered by *employés* of the Government. It has been too much the practice hitherto for those in authority to becloud the merits of those beneath them, and in many cases even to decorate themselves with laurels earned by others.

Colonel Dixon, who is highly respected, and not more for his professional ability than his urbanity, has offered an excellent example in his late distribution of prizes at Enfield; and on behalf of all who are in positions similar to those of Messrs. Hayes, Hague, and Williams we desire to see that example followed largely. It is not improbable that ere long some particulars as to the rate of production at the Enfield Small Arms Factory may be given, with other facts in relation to the place.

DUNN'S PATENT CARPET CLOTH.

WE had occasion a short time since to allude to this beautiful material, and the great interest which has been excited amongst manufacturers generally has fully corroborated our first opinion of it. That it will eventually supersede many of the articles now in use, from its great proximity to the appearance of carpet, in lieu of the present dirty substitutes, there can be but little doubt. The patentee, who was formerly with Messrs. Goodyear and Co., and now connected with the eminent firm of Messrs. Blackwood and Co., of Bread-street Hill, has favoured us with many details of this process, which is obviously destined to play a worthy part in the history of manufactures. It is certainly suggestive of a vast number of industries, as each individual interested in his own peculiar notions sees, even in its present position upon the mere threshold of usefulness, some one or other profitable application. We are informed that Mr. Dunn has discovered a mode of vulcanizing colours—a desideratum which has occupied the attention for years past of some of the greatest chemists of Europe, and which, according to the scientific journals of the continent, was conceived to be unattainable.

THE STEAM RAM.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—By the newspapers we are informed that it is determined to build a monster vessel, designated "The Steam Ram," which, from the description of her, is intended to run over or run down all swimming craft that she may upon the ocean obtain sight of. Little short of £500,000 is to be expended upon her construction and equipments. It may be presumption in me to question the prudence of such undertaking, or the prowess of this sea monster, but I would ask, How is she to run, with a chance of swimming, among submarine charges of gunpowder or explosive composition? Suppose, for instance, that she pursues a steam-vessel—a mite of a thing in comparison—armed with submarine explosive shells, suspended by buoys at any desired depth below the surface of the water; these shells may be regarded as submarine vessels in tow. The steamer so armed, upon being pursued, launches overboard one or two more of her shells, towing them by suitable ropes or chains. On comes the monster ram, and runs into contact with one or more shells, which are so constructed as to explode, by self-action, only when in *hugging contact* with any vessel that may be the object of attack or destruction. Now the result of such a collision would, I confidently predict, be the bilging of "The Steam Ram" to an extent beyond repair; down she would, in all probability, quickly go; and with her a crew of not less, perhaps, than a thousand men In all earnestness would I commend this matter to the careful consideration of those whom it may concern. I remain, Gentlemen, your obedient servant,

JOHN HARVEY, Captain R.N.

Sandgate, Folkstone, July.

[We do not quite perceive what conclusion it is towards which Captain Harvey would conduct us. Does he intend to imply that the new iron steam ship will be more exposed to submarine attack than any other large ship? And if not, would not his argument have equal cogency if directed against the building of any and every kind of large war-ship?—EDS. *M.M.*]

SCREW PROPELLERS.

Captain Beadon, R.N., sends the following:—

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—You remark in your magazine of the 1st instant in reference to recent experimental trials of screw propellers in H.M.S. Doris, that proof had been given that a blade formed of a fine flowing curve throughout would be more successful, as had been proposed by Sir Howard Douglas. I hope you will do me the justice to state that this is no other than the first and original form of screw propeller designed by me in 1834 to Captain Ericsson, keyed to a horizontal submerged shaft connected with steam power, and two years before patents had been obtained for the mangled principle either by Smith or Ericsson. On my return from China, in 1842, I again urged its adoption. In 1845 I patented it through Messrs. Robertson and Co., whose opinion you will see expressed in ten minutes reading, the last ten pages of which I devoted to illustrate the advantage of a curved blade, and its history, after actual experiment under steam power. In 1851 I exhibited the volute principle by a model at the Great Exhibition for six months, with a challenge appended. I am, yours faithfully,

GEORGE BEADON.

Crichtarrow, Taunton, July, 1859.

GRIFFITH'S SCREW PROPELLER.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—In your last publication I find two letters from Lord Carlingford claiming the merit of being the inventor of my patent screw propeller.

My first patent, including the large boss and tapered blades, was taken out in 1849; at that time I was not aware there was such a person as Lord Carlingford in existence and if his lordship will read my specification of 1849 he may satisfy himself that I could not have taken any idea from him, and I am ready at any time to try the validity of my patent with him.

I am, Gentlemen, your most obedient servant,

ROBT. GRIFFITHS.

69 Mornington-road, N.W., July 13, 1859.

THE GREAT EASTERN.

GENTLEMEN,—Your correspondent "A Reader," says that the employment of paddle-wheels in this ship destroys her usefulness as a sailing vessel. This is erroneous. The paddle-wheels are narrow, and small in diameter, in proportion to the vessel, and, being provided with disconnecting gear, I doubt whether two-horses power would be consumed in turning them when the vessel is going 10 knots under sail alone. The screw would consume a little more power, were it not provided (as I believe it is) with a small engine to keep it going just sufficiently to prevent drag. Although she will carry low rigging for her size, I think she will not only prove very handy under sail, but will, as a sailing vessel, beat any other sailing vessel in existence. I am, Gentlemen,

Your very obedient servant,

T. MOY.

1 Clifford's Inn, 12th July, 1859

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 4d. per line for any number of insertions less than 13; for 3 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

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Literature.

An Essay on Hydrographical Engineering, as applicable to Floating Sea Barriers, Harbours, Batteries, Coast Defences, and Naval Fortifications. By Captain ADDERLEY SLEIGH, K.T.S., F.R.S.L., &c. With Illustrations. London: Peller, 31 Poultry; and Stanford, Charing Cross. 1859.

WHEN we inform the reader that this work consists of only 58 pages of large leaded type, in a green paper wrapper—that its "illustrations" are lithographs from some of the roughest pen-and-ink sketches that we have ever seen—and that the main topic of the whole is a certain invention of the author's—he (the reader) will scarcely be induced to pay for it the sum of *ten shillings*, which Captain Adderley Sleigh modestly asks for it. We cannot look at this pamphlet without being instantly reminded of a work which, a short time since, passed under the notice of ourselves and our readers—Mr. Calver's pamphlet on the "Wave Screen" (J. Weale, 1858). The objects of both pamphlets are identical inasmuch as they were both written in advocacy of certain forms of sea barriers; but Mr. Calver's is not only the sounder, and in all respects the better book, but it is also, by very much, the cheaper of the two. There is also a great difference between the structures recommended by these two officers. Captain Sleigh advocates floating, Mr. Calver fixed, breakwaters: the former would incline their surfaces; the latter would make them vertical. There is much to be said in favour of, and much against, the plans of both. But there can be no question as to the relative capabilities of the two writers to discuss the subject. Captain Sleigh moves over the surfaces of many things. He was once in the Royal Navy; subsequently he joined the Land Transport Corps; now he is in neither. He is, moreover, the author of "A System of Military Portable Telegraphic Communication;" also, of a treatise on the "Nautical Re-organisation of the Mercantile Marine, and Manning the Navy by Voluntary Enrolment;" also, of a brochure on "The Amazon, or Suggestions for Preventing the Loss of Steam Ships;" also, of a set of "Climatic Statistics of Great Britain," &c., &c. He has now alighted upon batteries, harbours, coast defences, and so forth. We could scarcely expect anything very sound, or very profound, from such a source; and the pamphlet before us shows that if we had expected it, we should have been disappointed. With Mr. Calver the case is wholly different. He is by profession an hydrographer, and has for many years been the Admiralty Surveyor on the East Coast of England. His work answers to our knowledge of him.

Proceedings of Societies.

ROYAL AGRICULTURAL OF ENGLAND.

July 6.—Monthly Council; the Duke of Marlborough, President, in the chair. New members were elected. The usual monthly report of the Finance Committee was received. The thanks of the Council were voted to the Finance Committee for their past services.

Mr. Thompson, Chairman of the Journal Committee, reported:—

1. That in class III., Essay on Steam Cultivation, the prize of £25 is awarded to the Essay bearing the motto "Faint but pursuing," and on the seal being broken Mr. J. Algernon Clarke, of Long Sutton, was declared the author.
2. That in class VII. none of the Essays are considered worthy of the prize.
3. The following list of the subjects for prize Essays for 1860 is recommended to the Council:—

	£	s.	d.
I. Agriculture of Berkshire	50	0	0
II. On the best period of the rotation, and the best time for applying the manure of the farm	20	0	0
III. Alterations advisable in farm management, in land of different qualities, by low price of grain and high price of meat	10	0	0
IV. Late improvements in dairy practice	10	0	0
V. Proper office of straw in a farm ...	10	0	0
VI. Amount of capital required for the profitable occupation of a farm ...	10	0	0
VII. On the condition of seed-bed best suited to the various agricultural crops	10	0	0
VIII. On the adulteration of agricultural seeds	10	0	0
IX. Any other agricultural subject ...	10	0	0

4. The reprint of Dr. Lang's prize Essay on Potatoes is now laid on the table, and recommended to be sold at the following prices:—
   1*d.* each, or 6*s.* per 100 to Members of the Society.
   1½*d.* each, or 9*s.* per 100 to Non-Members.

Lord Leigh, chairman of the General Warwick Committee, presented the report of the Committee in reference to details connected with the Warwick meeting. Mr. Pain was elected one of the Stewards of Show-yard receipts in place of Lord Portman, who will be unable to attend.

Various communications were laid before the Council, and it was decided what replies should be given thereto by the Hon. Secretary.

Our Weekly Gossip.

THE civil service estimates for the year ending March 31st, 1860, are now in the hands of Parliament and the public in a printed form; and they certainly furnish information interesting to the latter who have "to pay," if not to the former who voted, the prescribed amount. Taking the estimate for the Royal Mint, we find that it presents a rather favourable aspect as compared with that for the last financial year, and a marked improvement in comparison with those of former years. Last year the amount required to defray the expenditure of the Mint, including coinage, was £36,639; this year it is £35,052 5s. 3d.; giving thus a reduction of £1,586 14s. 9d. Sundry variations in the details of the two estimates go to account for this difference. For instance, last year, under the head of "extraordinary expenses," were the charges for a new forty-horse power steam engine, a pair of rolls, &c., amounting to £2,745. This year "extraordinary expenses" are set down at *nil*. The loss, too, on silver coin withdrawn from circulation for recoinage, which in 1858-9 amounted to the average £10,000, this year sinks to £9,000. There is a saving, too, in the item of wages of artificers in the die department, caused by a diminution in their numbers to one half, of £512 2s. 4d.; whilst as regards the same class of workmen in the coining department, a reduction is shown to the extent of one man, and £41 12s. wages. Then, as set-offs to these prunings down, come items of additional expenditure in the shape of £5,000 for the expenses of silver coinage against £3,000 for the previous year; the ever-growing salaries of certain privileged officers, and other more trifling matters, leaving in the end the aggregate saving as shown above. The expenses for coining gold and copper are put down at the same sum for both years, namely, £6,666 and £1,500 respectively.

From the Annual Report of the Society of Arts we gather interesting intelligence respecting the operations of the several committees appointed by that Society in furtherance of scientific and artistic objects. The Gutta Percha committee has met several times, and is carrying out systematically its experiments. The Committee have had under their consideration the properties of the substance called "Pauchontee," an Indian gum, alluded to in the Council's report of last year as the produce of a tree of the same genus as that from which the true gutta-percha is produced. This substance has been carefully analysed and experimented upon, and a report as to its nature and properties has been sent, as requested, to the Indian Government. For this report, and the experiments and analyses, the Society are indebted to Mr. Dugald Campbell, one of the members of the Committee. From this report it appears that at the ordinary temperature it is hard and brittle, but upon the addition of heat, such as that caused by friction in a mortar, it becomes sticky and viscid, and when once this condition is reached, it does not after the lapse of several days assume its original consistence. When boiled with water, it becomes of a reddish brown colour, rendering the water turbid and slightly saponaceous. Experiments were made with a view to compare the properties of the gum with those of gutta-percha. For this purpose, the comportment of each, when brought into contact with various chemical re-agents in similar conditions, was particularly noticed, and the results are shown in a table accompanying the report. With some of the re-agents, the behaviour of the gum is precisely similar to that of the gutta-percha, while with others only a slight similarity is to be observed. Both seem to be nearly soluble in fuming nitric acid, while ordinary nitric acid and dilute nitric acid produce a similar re-action on both. In no one case can there be said to be a decided difference. Further experiments were made by dissolving similar quantities of gutta-percha and gum in equal portions of naphtha and turpentine respectively, and after pouring the solutions from the sediment, allowing them to evaporate at the ordinary temperature of the atmosphere. After standing to evaporate the solvent, the gutta-percha in each case had returned to its original condition, while the gum was soft and sticky, except when submitted to a considerable degree of cold, when it became brittle and friable as at first. From these results it will be seen that the gum alone could not be used for similar purposes to which gutta-percha is applied. Experiments were made in order to ascertain how far the gum could be mixed with gutta-percha without interfering to any great extent with the properties of the latter, and mixtures were made containing 5, 10, 20, 30, 40, 50, 60, and 70 per cent. of the gum and gutta-percha. From an examination of these mixtures it would appear that from 20 to 30 per cent. of the gum may be added to the gutta-percha without any material difference being noticed in the mixture to the gutta-percha alone. But it is necessary to observe, that these mixtures have not been put to the test of sunlight, air, &c., which are known to decay gutta-percha more or less, according to the nature of the gutta-percha (gutta-percha not being a perfectly definite substance) and the time it may be exposed, as their application may have to extend over some years before a result could be obtained of any value.

The Surgical Instrument Committee, which had just been appointed and organised at the time of the last report, has commenced its labours; and its various Sub-Committees, into which it has been divided, have prepared a complete catalogue of the instruments and apparatus employed for the investigation and treatment of disease. This list, drawn up under the direction of the several Sub-Committees, awaits now the formal sanction of the General Committee previous to its being published. Such a catalogue has long been wanting in the profession.

The Artistic Copyright Committee of last year having made its report, embodying the principles upon which an amendment of the law of copyright in works of art should be based, as likely to meet the requirements of the public on the one hand and of the artist on the other, it became the duty of the Council at once to endeavour to procure the passing of an Act of Parliament to secure such an amended law of copyright. With that view a small Committee, as an executive, over which Sir Charles Eastlake, P.R.A., consented to preside, was appointed, and numerous meetings having been held, a Bill was settled which it was hoped would have been before the Legislature during this Session of Parliament, but the unexpected dissolution of Parliament, and the consequent interruption of business, has prevented the subject from being investigated at present. The Council, however, will still use their best exertions to bring the matter before Parliament at the earliest time possible.

The Council of the same Society have had under their consideration the best means of rendering the action of the Society available for obtaining and diffusing among the public of this country information in reference to the productions, resources, and capabilities of the Colonies, and with that view a Committee was appointed early in the session to take charge of the subject. That Committee commenced its labours by seeking and obtaining the aid of the Secretary of State for the Colonies to enable the Society more fully to carry out its object. Sir Edward Bulwer Lytton at once consented to give such official assistance as might be required, and, at the request of the Council, called the attention of the Governors of our Colonies to the wishes and objects of the Society as expressed in a letter addressed to Lord Carnarvon, the Under Secretary, in which the Council state that the best measures for obtaining the object in view would be—1. That such Colonies as consider that the meetings and proceedings of the Society of Arts would at all serve to give publicity to their resources, and tend to increase the demand for their productions, should select some competent person, or existing Society in the Colony, to frame a complete statement of the points upon which it is considered that the public of the mother-country are not sufficiently informed. 2. That the individual or public body thus selected should at once be put in direct communication with the Society of Arts. 3. That the person or persons thus chosen should also designate, and obtain the consent of, some well-informed person in this country, either himself to read, at an evening meeting of the Society, the paper prepared in the colony, or to confer with the Council as to the best method of securing

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their common objects. Further proceedings may be later indicated, or may arise from the steps proposed. Should any Colony consider that a different course of proceeding would better suit the peculiar circumstances of that Colony, the Society of Arts will be quite prepared to receive such suggestions. The result has been that several of the Colonies are already in communication with the Society, and more will, no doubt, be added to the list before the Society resumes its meetings in November next, or when a sufficient time has elapsed for replies to be received.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement :—

STEAM ENGINES, &c., 2742.

BOILERS AND THEIR FURNACES, 2729, 2731, 2744.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2725, 2736, 2747, 2751, 2759.

SHIPS AND BOATS, including their fittings, 2721, 2752.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2734, 2748.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2755.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2727, 2741.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 2746, 2769.

LIGHTING, HEATING, AND VENTILATING, 2739, 2740, 2764, 2768.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2724, 2730, 2735, 2743, 2760, 2763, 2766.

METALS, including apparatus for their manufacture. *None.*

CHEMISTRY AND PHOTOGRAPHY, 2753, 2761.

ELECTRICAL APPARATUS, 2732.

WARFARE, 2762.

LETTER PRESS PRINTING &c., 2767.

MISCELLANEOUS, 2722, 2723, 2726, 2728, 2733, 2737, 2738, 2745, 2749, 2750, 2754, 2756, 2757, 2758, 2765, 2770.

2721. J. GRESHAM. *Improvements in apparatus for preserving ships' papers, and other papers and writings, in case of the loss of, or accident to a ship whilst at sea.* Dated November 29, 1858.

This consists in a buoy so constructed as not to sink in the event of its becoming water-logged, and to this end it is lined with cork between the cylinder and outside case. To distinguish it from other floating bodies it has raised conspicuously upon its surface a silvered globe. *Patent completed.*

2722. G. J. BENSEN. *Improvements in cleansing or purifying animal charcoal after it has been employed by sugar refiners.* Dated November 29, 1858.

Here the charcoal is placed in a vessel within which is a perforated false bottom; the charcoal is laid on this false bottom in a layer of uniform thickness, and the liquid with which the washing is to be performed is run on to the surface of the charcoal. A partial vacuum is then produced by pumps or otherwise in the space between the bottom of the vessel and the under surface of the false bottom, and this causes the washing liquid to pass respectively through the layer of charcoal, which is thus cleansed. In a similar manner air may be drawn through the charcoal and steam may be blown through it by leading steam by a pipe into the space between the bottoms of the vessel. The charcoal may be afterwards revivified by burning. *Patent abandoned.*

2723. D. EVANS and G. JONES. *Improvements in air pumps and water gauges.* Dated November 29, 1858.

Here a cylinder or barrel is used having three posts one near each end, and one in the middle of its length; within this barrel or cylinder two solid pistons are used which are fixed to the ends of their respective piston rods, one of which piston rods is hollow to admit of the outer piston rod sliding or working through it. These piston rods are worked by cranks so that the pistons alternately come towards and recede from each other. When they are coming towards each other the fluid between them is driven out at the middle part or opening, when they are receding from each other the fluid is driven out through the two end parts or openings, the middle part and the end parts alternately acting as induction and eduction ways. On the exterior of the cylinder or barrel is a valve box within which a slide valve is used capable of opening a way between the two end passages or parts and the main eduction way of the pump when the middle passages or part is acting as an induction way, and also capable of opening a way between the main outlet way of the pumps and the middle part or passages when the two end parts are acting as induction ways. The fluid is received into the valve box from whence it passes into the barrel of the pump, and is thence forced into the main outlet of the pump. When constructing a pump with two barrels, as described, it is preferred to use only one valve box and one slide valve for the two cylinders. *Patent completed.*

2724. J. LUIS. *A watch simplified with anchor escapements and rack, forming a double lever, catching in the pinion of its balance wheel.* (A communication.) Dated November 30, 1858.

The mounting of this watch is composed of a pallet plate on which is fastened the whole machinery of the watch, and on the surface the ordinary dial work of a watch is placed. The stop is fixed on the axle of the winding-up wheel as well as the dial. On the face is placed the machinery of the watch. The pallet plate forms the principal part of the box, and it is furnished with two hinges to receive the back of the box and the rim of the glass. A tail piece, with its eye or ring, is added to the pieces above mentioned. A hollow part in the pallet plate receives the spring and serves as an immovable barrel arbor; a wheel placed beneath turns of itself; to the middle of this wheel a spring ratchet wheel is fixed by a round axle passing throughout it, and turning at soft friction. When the watch is wound up in the core hole, round which the spring winds, the two pieces being adjusted together, the rachet wheel catches in its wheel, and presents the opening where the key is placed to wind up the watch on the side of the dial. The watch can be made to wind up at the back if desired. *Patent abandoned.*

2725. J. LUIS. *A new railroad with continued supports splintered together without any wood being used.* (A communication.) Dated November 30, 1858.

This consists in replacing wood by iron in the construction of railroads. It has for principle the direct support of the rail on the ballast in its whole length, and to give it the necessary stability by adding to the bar an auxiliary surface so as to obtain the same size of surface for support as in the road having cross beams. This auxiliary surface is not manufactured in one single piece with the rail, but at the time of placing the rails it is bound with it by hooks and belts of iron. *Patent abandoned.*

2726. A. A. BURTON. *A moveable face and handle for smoothing irons.* Dated November 30, 1858.

Here the stone is a hollow box similar in form to the smoothing iron, open at the top, having a toe or front covering piece to hold the iron in it, and at the other extremity a loose swing handle which doubles over the smooting iron handle. *Patent abandoned.*

2727. A. MARKS. *Improvements in the manufacture of braided articles.* Dated November 30, 1858.

This consists in causing a core of wood (or other material which is too rigid to permit of its being wound on reels and passed over pulleys) to travel while the braiding threads are being laid on it, so as to allow the work to be produced at all times at or very near one point, whatever be the length of core employed. The core is placed in a tube passing through the centre of the table, and rising above it nearly to the point where the braid is formed, and as the braid is produced the core is drawn up out of the tube by a cord passing over a pulley placed over the centre of the table, at a distance above it greater than that of the largest core to be covered. This cord passes to a take-up motion, and the tube serves as a guide to the core to keep it central while the core is being drawn up. When the core is not sufficiently stiff to remain straight in its length while it is being braided upon, it is kept straight by being held in a state of tension by a weight or spring. *Patent abandoned.*

2728. D. THOMSON. *Improvements in machinery for raising water and other liquids.* Dated Nov. 30, 1858.

The inventor constructs a wheel similar to an overshot water wheel, but with each bucket covered throughout the greater part of its length, leaving only a mouth open for the entrance and exit of the water. These buckets descend into the water as the wheel revolves, and come up full of water or nearly so. At the upper part of the wheel the water is discharged into a trough which is placed to receive it. Holes or passages may be made for ventilating the buckets or allowing the air to escape and enter as the water flows in and out. The wheel may be made to discharge at the circumference, or at the side, or at both sides, as may be desired. When variations occur in the level of the liquid to be raised the wheel is mounted on a shaft which can be raised and lowered while still remaining in gear with the driving pinion, &c., and the receiving trough may also be raised and lowered when required. *Patent abandoned.*

2729. J. THOW and T. M. HALL. *Preventing the fusion of fire-bars in locomotive or other furnaces.* Dated Nov. 30, 1858.

This consists in placing a small pipe running transversely under the heel of the fire-bars. In this pipe holes are to be drilled, one opposite to each space between the bars. On turning a cock with which this pipe is furnished, a jet of water will be thrown between the bars along their whole length, and the effect will be that the bars will be kept at a comparatively low temperature, and thus their fusion and all adherence thereto will be prevented. *Patent completed.*

2730. A. E. C. SCHEIDEL. *Improvements in fastenings for belts, braces, garters, hooks, porte-monnaies, portfolios, pocket-books, invoices, writing and cigar cases, reticules, bags, and other similar articles or purposes.* (A communication.) Dated Nov. 30, 1858.

On one side of a belt, *porte-monnaie*, &c., is fitted a clip, clasp, small case or recess, slotted, or with an opening in each side, or a double plate so connected as to have a groove on each side forming a shoulder piece, and on the end flap or other part of the belt, &c., is attached a frame or loop formed with cheeks, feathers, or tongues, or cut away at the inner sides so as to leave parts projecting inwards, which by moving the frame or loop, are caused to enter or slide into the slots or grooves in the holding piece to fasten the belt, &c., and are drawn out of such slots or grooves to unfasten it. There are modifications included. *Patent completed.*

2731. G. BOCCIUS. *Improvements in the construction of furnaces.* Dated Nov. 30, 1858.

The inventor provides the furnace with lateral flues running parallel with the fire-place through which he conducts air to the back thereof, and the ends of these flues he closes with copper plates pierced with fine holes which form the communication between the air flues and the fire-place. The gases of combustion pass off by a central flue, which is bent round to take the circuit of the fire place, and is brought into close proximity with the lateral air-flues. The air will thus be heated both by the direct heat of the fire-place, and also from the winding smoke-flue. *Patent abandoned.*

2732. W. E. NEWTON. *Improvements in telegraphing and in telegraphic apparatus.* (A communication.) Dated Nov. 30, 1858.

The object here is to produce an arrangement that shall not be susceptible to the changes of the weather, and that shall generate an amount of inductive electricity that shall answer all demands. The apparatus consists of an ordinary galvanic battery, using either one or more acids, a large inductive apparatus or coil, on Ritchie's or Rhumhorff's principle, and a simple arrangement for recording the signals. This arrangement consists of two metallic points approaching but not meeting each other on opposite sides of a strip of paper on which the signals are to be recorded. The paper is to be divided into two equal spaces by lines, and to be moved between the metallic points by clockwork, so geared as to move the paper forward the distance of one space at each beat or tick of the clock, and no more, and a single wire, either insulated or not, to convey the electricity. *Patent abandoned.*

2733. J. COLYER. *Improvements in machinery and apparatus for cutting and shaping staves and other parts of casks.* Dated Nov. 30, 1858.

This relates, first, to that part of stave-cutting called backing and hollowing. The blank to form the stave is fixed in a holder, so that it shall remain stationary during the backing, and that part of the wood intended for the outside of the cask is presented to a cutting tool so shaped as to give the required convexity to the back of the stave. The cutter travels along the stationary stave in a horizontal line, and is made to approach nearer to and recede from the stave to take off more or less wood as is necessary to give the bulge to the stave, by a guide rod or bar, the outer end of which is made to travel over a template Thus by varying the template the travelling cutter will cut the back of the stave to any bulge required. The hollowing of the stave is effected by the same machinery, the cutter being formed convex in lieu of concave. By using the same template all the staves will be backed to the same bulge. An arrangement of levers or springs ensures the same amount of tension on the belt which causes the cutter to rotate at every part of its travel. The holder for presenting the staves in the cutter has four arms radiating from a shaft or boss, and is provided with stops for retaining that arm, carrying the stave next to be cut exactly opposite the cutters. As soon as one stave is cut the holder is moved a quarter of a turn and a fresh stave is presented, and so on, whereby a continuous feed is maintained. *Patent completed.*

2734. J. COULSON. *Improvements in threshing and dressing machines.* Dated Nov. 30, 1858.

This consists, 1, in forming the springs or bars by which the shoes, riddles, and shog-boards of the shifting or riddling apparatus of threshing and dressing machines are suspended thicker at the ends than at the middle. The said springs or bars may be of wood or steel. 2, in forming the beating surfaces of the beaters of threshing machines of a half-octagon form in section, three of the sides having oblique ridges or projections placed in opposite directions. *Patent completed.*

2735. A. STENGER. *Improvements in the manufacture of cravats, braces, belts, and waistbands.* Dated Dec. 1, 1858.

This consists in manufacturing these articles in a braided form. They are made of silk, cotton, &c., in an ordinary braiding machine. *Patent abandoned.*

2736. R. H. BOW. *Improvements in railway chairs and fastenings.* Dated Dec. 1, 1858.

This relates to an arrangement of railway chairs wherein the rail is held by three dead or fixed resisting surfaces, the retaining pressure upon which is brought into play by a fourth pressure arising from the action of a binding wedge or key, or otherwise. The three dead pressures are those of the pressure of the bottom of the rail upon the sole of the chair, the centre of the well of the rail against the top of the inner and lower jaw of the chair, and finally the pressure of the outer side of the upper flange of the rail against the outer and higher jaw of the chair. These three pressures are brought into action by the pressure of a key of circular or other transverse section fitting into and pressing against a corresponding concavity in the interior of the higher jaw of the chair on one side, and on the other against the outer side of the rail at the point where the lower side of the web joins the bottom flange. When the key or other binding and adjusting agent is driven into its place the pressure exerted by it binds the rail against the three resisting surfaces of the chair and holds it tight. The chairs themselves generally resemble the common form, but the inner jaw is only about half the height of the outer one, and the latter is formed with a shallow concavity running horizontally along its central position. *Patent completed.*

2737. J. LOACH and J. COX. *Certain improvements in ornamenting the surfaces of japanned goods, and which said improvements are also applicable to the ornamenting of certain other surfaces.* Dated December 1, 1858.

This consists in forming ornaments from scraps of perforated zinc or other metal placed together so as to form the ornament desired whether on a round, curved, or flat surface. Over this the inventors lay on black japan or other coloured paint so as to imbed such metal ornament. After drying the whole is rubbed down and polished, when the metallic ornament will be defined by the contrast of its bright surface with the ground on which it is inlaid. In this state they paint certain parts of the metallic ornaments with transparent colours. *Patent abandoned.*

2738. E. JONES. *An improvement or improvements in the manufacture of coke in ovens.* Dated Dec. 1, 1858.

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This consists in introducing air heated by the waste heat of the oven into the said oven during the process of coking. *Patent completed.*

2739. T. P. PURSSGLOVE. *An improved pressure gauge for steam, gas, or other fluids.* Dated Dec. 1, 1858.

This consists principally in the arrangement of a series of pairs of tubes, each tube forming in itself a mercury gauge similar to the one commonly known as such. *Patent completed.*

2740. R. LAMING. *Implements in purifying gas, and in turning sulphuretted hydrogen, carbonic acid, and ammonia, or their compounds to profitable account.* Dated Dec. 1, 1858.

The details of this invention are too voluminous for our pages. *Patent completed.*

2741. C. F. VASSEROT. *An apparatus for printing with different colours thread to be applied to the manufacture of textile fabrics.* (A communication.) Dated Dec. 1, 1858.

The threads are rolled upon bobbins, and a certain number of bobbins is placed upon a bobbin holder, from which the threads pass through a comb divided according to the number of threads to be coloured at the same time. Immediately behind the comb are fixed two rollers which press upon the threads and conduct them between two cylinders, one of which, the printing cylinder, bears the design to be reproduced, and the other serves as a printing table. This last-mentioned roller receives its motion by a pinion mounted upon the shaft of the main pulley of the machine, and communicates it to the printing cylinder, which in its turn transmits it to two rollers which feed the cylinders with colour. After leaving the cylinders the threads are conducted upon a reel, the motion of which is regulated according to the speed of the machine. *Patent abandoned.*

2742. J. SAMUEL and J. NICHOLSON. *Improvements in, and in connection with, marine and other steam-engines.* Dated Dec. 1, 1858.

This was described and illustrated in No. 28, at page 25, of MECHANICS' MAGAZINE (New Series.) *Patent completed.*

2743. E. VINEY. *An improvement in the construction of portmanteaus, desks, dressing-cases, despatch boxes, and other like articles.* Dated Dec. 1, 1858.

This consists in constructing portmanteaus, desks, dressing cases, &c., each with an envelope case or cover flexible throughout, or in part only, which cover slides in grooves at the sides or ends of the article, and either wholly or partially encloses the contents thereof. *Patent completed.*

2744. H. ADCOCK. *Improvements in furnaces and apparatus for annealing wire.* Dated Dec. 1, 1858.

Here the annealing pot or vessel is set in the centre of the furnace, and is partly protected by a casing of brickwork at its lower parts, but in place of having only one fire-grate, by preference three are constructed at equal distances apart, so as to apply heat more uniformly around the pot or vessel, the inner ends of the firegratings surrounding, or nearly surrounding, the pot or vessel. *Patent completed.*

2745. F. WARNER, J. DERBYSHIRE, and A. MANN. *An improvement in the manufacture of cocks or taps.* Dated Dec. 1, 1858.

Here a valve is suspended to or formed on the end of a tube of india-rubber. The other end of the tube is flanched so as to attach it to the body of the cock or tap. The spindle or screw by which the valve is pressed on its seat passes into the tube, which is shorter than the distance between the valve seat and point of connection of the flanch of the tube, so that the tube will require to be extended in length to close the valve, and the tube will when released aid in lifting the valve from its seat. *Patent completed.*

2746. G. W. BALES. *Improvements in apparatus for retaining doors, sashes, or frames, when shut or closed.* Dated Dec. 1, 1858.

Here a plate is fixed to the edge of a door-sash or frame, or to the post or frame against or in which the same is shut or closed. Through this plate a hole is formed to admit of a portion of a sphere protruding through. The sphere or such-like bolt is contained within a tube or chamber at the back of the plate, which chamber is closed at its end, and between the end of the chamber and the back of the sphere a spring is applied, which constantly presses the sphere outwards on the door-sash, or frame; or on the post or frame against which the same closes is another plate, having a hole to receive the protruding part of the sphere. By this arrangement the sphere has not only the capability of rotating, but also of receding, by which the door, sash, &c., may be opened and closed simply by pressure, and without otherwise acting on the sphere which acts as the bolt or retaining instrument. Provision may be made for fastening the sphere or bolt when shut and thus prevent it acting till unfastened. *Patent completed.*

2747. H. BESSEMER. *Improvements in railway and other wheels and wheel tyres.* Dated Dec. 1, 1858.

This consists, 1, in the use in one wheel or tyre of two or more kinds of iron, or of two or more qualities of steel, or the employment or combination of iron and steel of any desired kind or quality in the formation of a wheel, or wheel tyre, by the process of founding. 2, in the use of molten iron of any desired kind, or of molten steel of any suitable quality, or of iron and steel with other iron or steel in a heated and wrought or unwrought state in the manufacture or founding of wheels and tyres by centrifugal apparatus. *Patent abandoned.*

2748. S. NEWINGTON. *Improvements in agricultural implements.* Dated Dec. 1, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2749. A. E. DAVIS and R. WRIGHT. *Improvements in the manufacture of colouring matter for spirits and other liquids.* Dated Dec. 1, 1858.

This relates to the manufacture of colouring matter from certain farinaceous substances, and from sugar or syrups made from the same. The materials are wheat, barley, oats, rice, or maize. *Patent abandoned.*

2750. F. FINCHAM. *Improvements in the construction of annealing kilns or ovens.* Dated Dec. 1, 1858.

This consists in a mode of conveying cool air through pipes of earthenware, stoneware, &c., the ends of each two adjoining lengths being brought together within a length of larger pipe of the same shape or form, so as to allow for any contraction or expansion of the inner pipes, but at the same time to prevent the sand or material used from running into the pipe. These pipes are to be so arranged under the whole bottom or sole of the kiln and embedded in the sand or other material (under the open brickwork) as to allow the external air to pass through them freely when required, the ends of the pipes by which the air is admitted being furnished with slides or shutters to regulate the admission of the air, and the other ends opening into a shaft or chimney. *Patent completed.*

2751. L. BISSELL. *Improvements in trucks for locomotive engines.* Dated December 1, 1858.

This relates to a former patent dated the 5th of May, 1857, and consists in the use of a rigid truck frame, moving on a fixed centre, that is, located between the centre of the driving wheels and the truck wheels; this frame carries the journal boxes of the truck wheels, and sustains the forward end of the locomotive on double inclined bearing blocks resting on double inclined bearings on the truck frame. Thus two truck wheels can be used, in consequence of the fixed centre where the truck frame is attached to the boiler becoming a bearing point to steady and sustain the two truck wheels. *Patent completed.*

2752. J. LEWIS. *Improvements in means for attaching sails to the yards of ships or vessels.* Dated December 1, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2753. E. L. BENZON. *The manufacture of useful alloys of aluminium.* (A communication.) Dated December 1, 1858.

The object here is the manufacture of useful alloys of alluminium by the decomposition of alumina, or the oxide of alluminium by means of carbon in the presence of, and in intimate contract with certain metals electro positive to alluminium (such, for instance, as copper, or iron, or their oxides), so as to cause the alluminium to combine with the electro positive metal and form an alloy. *Patent completed.*

2754. L. MACKIRDY. *Improved combined bathing, washing, and water closet apparatus.* Dated December 2, 1858.

This consists in combining a foot bath, body or sitting bath, shower bath, washing bason, and water-closet in one apparatus. *Patent completed.*

2755. L. MACKIRDY. *Improvements in the manufacture of sugar.* Dated December 2, 1858.

Here frames are used to receive the moulds, and these frames are either themselves mounted upon wheels, or have wheeled carriages provided to receive them, so that the moulds can with facility be brought to the heaters to be filled, and removed to any convenient situation for drainage. Arrangements are also made to place the mould frames or carriages at a level or near the heaters, sufficiently low to admit of the liquid being directly run into the moulds by taps or spouts, and the discharge of each heater may be effected through two or more branchpipes or spouts arranged to fill two or more moulds at once. Thus if there are two moulds in each row in a frame the heater may be provided with the discharge branches, so that both moulds of each row may be filled simultaneously. The mould frames have printed studs or spikes upon which the apex apertures of the moulds are entered, and which studs thus serve to close the said apertures whilst the sugar remains liquid. When the time arrives for draining the sugar each mould is lifted off its stud or studs, and its apex is inserted in an aperture or socket, and the liquid drains off into a pan fitted into the bottom of the frame or carriage. *Patent completed.*

2756. J. ROGERS. *Improvements in the manufacture of ropes, cables, cords, and lines.* Dated December 2, 1858.

For electrical purposes, this consists in laying together longitudinally plaited or braided bands, or twisted cords or lines of hemp, flax, jute, cotton, silk, &c., around a core of wires, and binding the whole together by hitching, sewing, whipping, or plaiting over with wire, thread, cotton, silk, or other suitable material, and saturating the same with a composition composed of boiled oil, rosin, patent dryers, tallow, and pitch, tar, or dissolved india-rubber. These ingredients are mixed and boiled together. The mixture may be applied either in a hot or cold state. For other than electrical purposes a core of yarns, &c., is used. *Patent abandoned.*

2757. W. ROBERTSON and J. G. ORCHAR. *Improvements in machinery or apparatus for winding yarns or threads.* Dated December 2, 1858.

This relates, under one modification, to varying the spindle's rate through the frictional contact action of the circumferential edges of the frictional driving pulleys, with the lower frictional faces of the pulleys on the spindles. It also relates to a previous patent of the patentees dated 27th February, 1857, and consists in disposing the winding bobbin lower down on the spindle, and in an arrangement for gaining room for more spindles. *Patent completed.*

2758. J. TYSSEN. *Improvements in obtaining and applying motive power.* Dated December 2, 1858.

This consists in obtaining and applying motive power by compressed air and water combined and made to act upon a wheel enclosed in a case to prevent the water escaping before it has produced its effect. The compression of the air and water is effected in an air-tight vessel by the aid of force pumps or otherwise. In cases where the motive power thus obtained is not sufficient to work the pumps, a supplementary steam boiler and donkey engine are combined with the apparatus for that purpose. *Patent abandoned.*

2759. J. BAILLIE. *Improvements in the construction of railway wheels.* Dated December 2, 1858.

The object here is to make a wheel avoiding all the objections and defects of the chilled cast iron wheels cast in one piece, as well as those made against wrought iron or steel tyres, and to secure the advantages of the hard and durable chilled surface at the tread or periphery of the wheel, while at the same time the dangerous character of the chilled cast iron wheels (cast in one piece) is avoided. The invention is not described apart from the drawings. *Patent completed.*

2760. G. SPILLER. *Improvements in knapsacks for military and other purposes.* Dated December 2, 1858.

Here on the under side and near the centre between the front and back of the knapsack are placed two movable supporters, formed of metal or other suitable material, the same working upon joints, at their inner ends being provided with holes which take into eyes at the ends of the slings. The slings can be lengthened or shortened so that the knapsack can be raised or lowered by the wearer without in any way confining the arms. A pocket is also formed at the back of the knapsack opening with a flap at the bottom for placing in the great coat. The knapsack is of an oblong form, and worn in an upright position. *Patent completed.*

2761. M. HENRY. *Improvements in manufacturing and revivifying bone black or animal charcoal, and in kilns and apparatus employed therein.* (A communication.) Dated December 2, 1858.

For receiving bones to be carbonized or bone black to be restored, receivers are employed raised upon feet and fitted upon escape valves. The kiln in which the receivers are placed has a fire place at each corner of the sole, and is so constructed and provided with passages for the flames and products of combustion so that they may completely surround the receivers, and thoroughly heat them and their contents. *Patent completed.*

2762. T. BAILEY. *A mechanical movement applicable to loading fire-arms and other purposes.* Dated Dec. 3, 1858.

This consists in the adaptation and application of a toothed wheel or pinion on a travelling centre working between guides, and also working between and in gear with a pair of racks, one of which is stationary, the centre of the wheel changing its position or travelling in the same plane with the guides as the wheel works in the teeth of the racks, such centre not being fixed as usual. *Patent completed.*

2763. M. TOOKE. *Improvements in apparatus for measuring the human figure, and applying the same for tracing out garments for the human figure.* Dated Dec. 3, 1858.

This consists in the use of certain metal bands for encircling the body, in combination with suitable tapes, measures, and indexes, together with other arrangements. *Patent abandoned.*

2764. G. E. NOONE. *Certain improvements in machinery for generating gas from coal.* Dated December 3, 1858.

This consists, 1, in the application of a cylindrical back to kitchen ranges, &c. 2. In a kind of semi-circular cylinder called a feeder with perforated moveable front to be charged with coal for gas making. 3. In an apparatus for placing the feeders in position in cylinder back when charged with coal, and for relieving the same from coke; and also in a kind of sheet iron shield to keep dust from the gearing. 4. In a portable apparatus for purifying gas, which by a peculiar application is rendered a wet and dry purifier, combining also a mode of sealing to prevent explosion. 5. In a mode of regulating the pressure for consumption of gas, and for self-supplying the whole machine with water for cleaning &c., with the means of communicating motion to the call bell when coal is required. 6. In a peculiar construction of furnace to generate gas and steam at the same time and with the same coal. 7. In a kind of iron truck for withdrawing hot feeders from the furnace and replacing others. The invention is not described apart from the drawings. *Patent completed.*

2765. S. PETERS. *Improvements in the manufacture of pipes and tubes, and in the apparatus employed therein.* Dated December 3, 1858.

Here the sheet metal is first heated in an oven or furnace, and then passed between rollers of which the lower is grooved with grooves of different sizes, and the upper has corresponding projections, so that as the heated strip or sheet of metal is passed between the two in one or other groove according to the size of the pipe or tube to be made, it may be pressed into the form of a U. The bent sheet or strip then passes between other grooved rollers in the same machine which impart to it a tubular form. The partially formed pipe or tube is then again heated in an oven or furnace to a welding heat, and passed through a pair of grooved rollers, the grooves of one of which are larger than the corresponding grooves of the other, and the former roll is driven at a less velocity than the latter. During its passage through these welding rollers the pipe or tube is supported by a double mandril. *Patent abandoned.*

2766. E. S. JONES. *Improvements in cornets, trumpets, horns, and similar musical wind instruments.* Dated December 3, 1858.

This consists in a mode of connecting the main tube of the instruments with the small tubes for allowing the current of propelled air to pass direct from the main tube to one or other of the small tubes, and by appropriate mechanism to bring the main tube into direct communication with the side tubes, without the aid of a perforated piston. *Patent abandoned.*

2767. C. COATES. *Improvements in mandrils for printing.* Dated December 3, 1858.

Here the body of the mandril is made so that it goes easy into the copper printing roller, and is made conical at each of its ends. Over each of these conical ends a hoop of iron or steel is placed, the external diameter of which is turned to about the internal diameter of the copper roller, and its interior is made to fit the conical part of the mandril. The iron or steel hoop is also cut longitudinally in one or more places. When the mandril is put into a copper roller the hoop is forced up the conical part of the mandril, by nuts screwing on to the ends of the mandril, which expands the hoop and causes it to press against the inside of the roller, which will thus be held securely. The nuts screwing on to the ends of the mandril are made circular, and may have a

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screw thread cut in their outside, on to which another nut can be screwed, so as to act as a collar to prevent the copper roller moving endways on the mandril. If the hoops are cut in more than one place so as to form two or more wedges, a pin is passed through each end of the mandril, and the ends of the pins work in recesses in the wedges. The wedges are also retained by a flexible hoop or spring which passes around them and presses them against the mandril. Thus the wedges are prevented from turning round, and also from falling off the mandril. *Patent abandoned.*

2768. C. F. VASSEROT. *An improved apparatus for ventilating mines, or other similar purposes.* (A communication.) Dated December 3, 1858.

This consists of a cylinder formed of strong sheet zinc having an air passage attached to its side, with valves opening out from or into the cylinder according as it is to be used for ejecting and injecting air. To the one extremity of this chamber the hose or tubes are attached which convey the air from or to the cylinder. In each end or each cover of the cylinder is fixed a valve opening inwards or outwards, and which serve as the means either to expel or take in the air. The cylinder has a piston and rod which works within it, the piston having its face covered with a stuffing of india-rubber which is arranged so as to form two lips or rubbing parts, and the space in the middle being bent or compressed hollow so that there is always a pressure upon the outer edges. *Patent abandoned.*

2769. C. F. VASSEROT. *Improved arrangements to be applied to window sashes to prevent draughts and the infiltration of water.* (A communication.) Dated Dec. 3, 1858.

Here a movable iron band is mounted upon hinges, and has at each end a spiral spring which is intended to cause the band to fall on the sill or frame when the window is opened. When the window is closed the movable band will be raised to a vertical position by two or more projections placed upon the frame of the window, and being kept in this position by the said projections it will prevent any water or draught from the outside. *Patent abandoned.*

2770. H. BEVAN. *New or improved machines for effecting or facilitating arithmetical operations.* Dated Dec. 3, 1858.

This consists of machines in which a series of figures are arranged either on the peripheries of discs, or on plane surfaces, the said discs or surfaces being capable of such changes of position as to produce under proper manipulation, and the mere process of simple addition, the product of any two numbers which it may be wished to multiply, as well as to effect or facilitate other arithmetical operations. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 21, 1859.

1488. G. Tomkins, of Pontymister, near Newport, Tinplate Worker. Improvements in coating metals and in the apparatus connected therewith.

1490. S. Gibbs, of Eddington, near Canterbury. Improvements in apparatus for slinging horses, mules, and other animals.

1492. J. Meikle, of Glasgow. Improvements in coating iron ships with asphalte, which improvements are also applicable to coating other surfaces.

1496. E. Oliver, of King William-st., City. Improved medicinal mixtures for the cure of rheumatism, tic doloreux, lumbago, cramp, sciatica, and such like complaints.

Dated June 22, 1859.

1502. W. Goulding, of Leicester, Plough-maker. Improvements in the construction of ploughs.

1504. W. Russell, of Leicester, Ironmonger. Improvements in wheels for ploughs, cultivators, and other implements or carriages.

1506. J. Apperly, Cloth Manufacturer, and W. Clissold, Engineer, of Dudbridge. Improvements in the manufacture of wheels for carriages and engines.

Dated June 23, 1859.

1508. J. Luis, of Welbeck-st. A machine for corking bottles. A communication from J. Peury.

1509. C. F. and C. J. Varley, of Kentish-town. Improvements in proving electric conductors, and in the apparatus connected therewith.

1511. E. T. Hughes, of Chancery-lane. Improvements in the manufacture of artificial sand-stone, bricks, tiles, and similar articles. A communication from L. and E. P. de Lafarge.

1513. A. Prince, of Trafalgar-sq. Improvements in alarum locks and latches.

1514. H. Doulton, of Lambeth. Improvements in earthenware jars and bottles.

1515. A. V. Newton, of Chancery-lane. Improvements in springs for resisting sudden and continuous pressure. A communication from C. Perratone, and Messrs. J. F. Call and Co.

Dated June 24, 1859.

1516. W. Lister, jun., Master Mariner, and T. G. Garrick, Agent, of Sunderland. Improvements in ships' windlasses, and other like apparatuses, applicable also to the steering of ships.

1517. J. Mills, of Heaton Norris, Machinist. Improvements in the manufacture of keys and gibs, and in the machinery employed therein.

1518. A. Chesneau, of Paris, Merchant. Improvements in paddle-wheels.

1519. W. Clark, of Chancery-lane. Improvements in sewing machines. A communication from J. S. Goodridge.

1520. G. Redrup, of Loughborough, Brewer. Machinery for the cutting of shives, bungs, corks, spiles, and vent or other pegs.

1521. R. Hornsby, jun., of Grantham. Improvements in ploughs, and in giving motion to ploughs and other agricultural implements by steam-power.

1522. P. Faure and J. Pernod, of Avignon, France. An improved process for utilising the residues of madder in the manufacture of garancine and other preparations of madder.

1523. J. Drury, of Exley, near Halifax, Engineer. Improvements in steam-engines and boilers.

Dated June 25, 1859.

1524. T. Howard, of King and Queen Iron Works, Rotherhithe, Engineer. Improvements in condensing steam in engines where superheated steam is used.

1525. W. J. Sluce, of Bethnal Green-road, O. Murrell, of Bethnal Green-road, and W. Hudson, of Hackney-road. An improved method of generating steam.

1526. C. W. Williams, of Liverpool. Improvements in steam-boilers.

1527. W. E. Newton, of Chancery-lane. Apparatus for exhibiting stereoscopic pictures. A communication from J. S. Perry.

1528. J. Roberts, of Upnor, Terra Cotta Manufacturer. Improvements in filters.

1529. J. Boden, of Southampton, Engineer, and W. Clark, of Southampton, Boiler Maker. Improvements in apparatus for superheating steam.

1530. S. Russell, of Sheffield, Manufacturer. Improvements in breech-loading fire-arms, and in projectiles to be used therewith.

1531. W. Coppin, of Londonderry, Marine Architect. Improvements in apparatus for raising sunken and stranded vessels and their cargoes, and for raising and lowering other bodies into, and out of, the water, parts of which improvements are applicable to raising weights generally.

Dated June 27, 1859.

1533. G. Wrigley, of Dunkinfield, Machine Maker, and T. H. Wrigley, of Mossley, Overlooker. Improvements in self-acting mules for spinning and doubling.

1534. D. J. Fleetwood, of Birmingham, Copper Agent. An improvement or improvements in shaping metals.

1535. B. Burton, of Brooklyn, U.S. Improvements in breech-loading fire-arms.

1536. G. Smith, of Orange County, U.S., Engineer. An improved construction of primer for fire-arms.

1537. T. Leigh, of St. Mary Cray, Millwright, and J. Line, of the same place, Paper Maker. An improvement in paper-making machinery.

Dated June 28, 1859.

1540. A. V. Newton, of Chancery-lane. Improved machinery for cutting corks. A communication from E. Conroy.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1561. L. L. Tower, of Massachusetts. A new and useful machine for damping and wetting paper, &c. A communication from J. A. Lynch. Dated June 30, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, July 12, 1859.*)

543. J. Templeman. Artificial fuel.
545. D. Lichtenstadt. Paper and other fabrics.
551. W. F. Dearlove. Chopping machine.
563. J. Harrison. Rotating window sashes.
573. C. F. Dennet. Bayonets.
575. J. Cowban and E. Andrews. Spinning.
576. R. A. Brooman. Boiler stays. A communication.
586. G. Leach. Reeling yarn.
598. J. P. Clarke. Reels for cotton, &c.
610. J. A. Williams. Cultivating land.
621. J. Yuill. Saddle-trees.
623. H. Lodge. Protecting ships' batterics.
643. T. Lightfoot. Fixing colours on fabrics.
655. J. Dixon and R. Clayton. Rolling iron and steel.
664. W. Avery. Screws.
665. J. Michel-Denys. Railway crossings.
753. W. Clark. Separating oats from chaff. A communication.
770. B. and C. L. Smith. Dyeing and printing.
810. F. Morton. Fences and posts.
811. W. E. Newton. Cleaning rice. A communication.
881. W. Hooper. Insulating conductors.
882. W. Hooper. India-rubber.
921. R. A. Brooman. Red dyes. A communication.
981. F. and W. Edwards. Looms.
1033. T. A. Weston. Pulley.
1060. J. Holroyd. Finishing cloths.
1335. A. Mickelthwate, J. Peace, and S. J. Hobson. Coating springs and bands.
1350. G. H. and H. R. Cottam. Stable fittings.
1372. A. V. Newton. Millstones. A communication.
1392. R. R. Fairgrieve and S. Bathgate. Winding yarns.
1394. J. and W. Henderson, T. Bagley, and S. Holdsworth. Looms.
1420. F. A. T. de Beauregard. Generating steam.
1428. A. V. Newton. Boats. A communication.
1437. A. V. Newton. Polishing wheels, &c. A communication.
1488. G. Tonkins. Coating metals.
1497. R. Smith. Looms.
1501. C. Clarini. Metal nails.
1516. W. Lister, jun., and T. G. Garrick. Ships' windlasses, steering, &c.
1529. G. Redrup. Cutting shives, bungs, &c.
1521. R. Hornsby, jun. Ploughs.
1529. J. Boden and W. Clark. Superheating steam.
1561. L. L. Tower. Wetting paper. A communication.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 8, 1859.

69. J. T. Forster.
72. R. D. Clegg.
83. W. Tillie.
84. D. E. Hughes.
87. C. W. Siemens.
88. F. Versmann and A. Oppenheim.
89. N. P. Burgh.
92. W. Oliver.
103. C. Beslay.
105. R. A. Lightoller.
118. T. Herbert and E. Whitaker.
126. J. Daughish.
181. J. L. Clark and J. Muirhead.
211. R. Mushet.
236. I. Hammond.
265. J. Lane.
278. J. P. Booth.
497. G. Turnbull.
1083. J. Toussaint.
1153. R. Pearsall.
1155. R. D. Kay.
1203. J. H. Johnson.

Sealed July 12, 1859.

106. W. Bennetts.
110. J. Picksley and R. Sims.
112. D. L. Banks.
113. J. J. Stevens.
114. F. J. Manceaux and E. N. Vieillard.
115. J. Grist.
122. S. Holt.
125. W. Davis.
131. D. L. Banks.
431. W. E. Newton.
499. J. Robinson.
899. R. Wappenstein.
939. E. Partridge.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1578. J. Lewtas and J. Humphreys, jun.
1583. L. Blackstone.
1586. R. Shaw.
1587. A. L. S. and E. C. A. Chenot.
1588. A. L. S. and E. C. A. Chenot.
1589. A. L. S. and E. C. A. Chenot.
1590. A. L. S. and E. C. A. Chenot.
1595. W. Laing.
1616. W. B. Adams.
1622. T. Jerome.
1638. R. Harrington.
1647. W. B. Adams.
1661. W. Watt.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending July 8, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
2487	0 10	2751	0 7	2764	1 1	2781	0 3	2794	0 6	2806	0 5
2625	1 4	2752	0 6	2765	0 3	2782	0 3	2795	0 6	2807	0 3
2739	0 7	2753	0 4	2766	0 3	2784	0 7	2796	0 3	2808	0 11
2740	0 5	2754	0 7	2767	0 10	2785	0 3	2797	0 4	2809	0 6
2743	0 5	2755	0 7	2768	0 3	2786	0 3	2798	0 3	2810	0 9
2744	0 10	2756	0 3	2769	0 3	2787	0 10	2799	0 3	2811	0 3
2745	0 5	2757	1 0	2772	0 7	2788	0 6	2800	0 3	2812	0 3
2746	0 5	2759	0 9	2774	0 6	2789	0 3	2801	0 3	2815	1 4
2747	0 3	2760	0 6	2775	0 7	2790	0 3	2802	0 3	...	...
2748	0 7	2761	0 10	2777	0 5	2791	0 9	2803	0 3	...	...
2749	0 3	2762	0 9	2778	0 3	2792	0 5	2804	0 10	...	...
2750	0 5	2763	0 3	2780	0 3	2793	0 7	2805	0 3	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, 13th July, 1859.

	£ s. d.	£ s. d.	Dis. p. ct.
IRON, Rails in Wales and N. of England ..... pr. ton	6 0 0 to	6 5 0	nett
Welsh Bars, in Wales .. „	6 0 0		5
Staf. Bars at the Works „	7 0 0 „	7 10 0	2½
„ Hoops ..... „	8 0 0 „	8 10 0	„
„ Sheets, Singles .. „	8 10 0 „	9 0 0	„
„ Nail Rods ..... „	7 0 0 „	7 10 0	„
„ Boiler Plates ..... „	8 10 0 „	9 0 0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow ..... „	2 14 6 „	2 14 9	nett
Do. No. 1, Good Brands „	2 15 0 „	2 17 0	„
Scotch Bars ..... „	7 5 0 „	8 0 0	5
Swedish Bars, in London „	13 10 0 „	13 15 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 11½		5
Tough Cake and Tile „ ton	103 10 0		„
Best Selected..... „	105 10 0		„
Australian ..... „	110 0 0		„
South American			„
Yellow Metal Sheathing ..... per lb.	0 0 9½		„
STEEL, Swedish Keg ..... pr. ton	19 0 0 „	19 10 0	2½
„ Faggot ..... „	21 0 0 „	21 10 0	„
TIN, English, Block ..... pr. cwt.	6 18 0		2½
„ Bar..... „	6 19 0		„
Foreign, Banca ..... „	7 6 0		nett
„ Straits..... „	7 0 0	7 3 0	„
TINPLATES, Charcoal, I.C. .. pr. box	1 14 0 „	1 15 0	5
Coke, I.C. ..... „	1 7 0 „	1 9 0	„
LEAD, Pig, English ..... pr. ton	22 15 0 „	23 5 0	2½
„ Spanish ..... „	22 0 0 „	22 10 0	„
Sheet ..... „	23 15 0 „	24 10 0	„
SPELTER, on the spot ..... pr. ton	21 2 6	21 10 0	nett
for arrival..... „	21 5 0 „	21 10 0	„
ZINC, English, Sheet ..... „			1½
QUICKSILVER ..... per btl.	7 0 0		1½

REMARKS.—The more speculative articles of Metals have been materially affected by the peace news. Scotch Pig-iron has advanced upwards of 5s. per ton. Spelter is higher by about £2 per ton. English Tin has been successively advanced £9 and £4 per ton—the whole of the quantity of Banca put up for sale by the Dutch Company having been taken at a price equal to about £142 per ton here, and the article is now firm at about £146 per ton. Copper and Lead are as yet without change.

LAWRIE AND HAGGER, Metal Brokers.
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 22, 1859.

RIFLED GUNS FOR THE NAVY.

THROUGH all the mists of doubt and perplexity which envelope the subject of our national defences one clear principle shines steadily forth for our guidance, viz., that at no time, and for no cause, must we permit any nation whatever to surpass us in the selection or production of naval and military weapons. There is no class of politicians in this country, we believe, who will for a moment question the truth of this principle, nor is there any who will deny that of the various services, the navy is that which least of all must be permitted to be inferior in any respect. Yet there are grave reasons, we regret to say, for believing that the French are silently assuming a vast superiority to us in one very important particular.

More than a month since we were privately informed, by a gentleman whose authority in all matters relating to guns, whether cannon or small arms, we have great cause to trust implicitly, that a large number of naval guns were being rapidly rifled in the French ports. This information had not long been received when the Marseilles correspondent of the *Times*, in visiting the arsenal at Toulon, discovered several of the rifled guns on the wharves there, and learnt that many more smooth-bore guns were undergoing the process of rifling. This intelligence he duly communicated to the public in the columns of the leading journal. More recently (on July 9th) the same gentleman, through the same channel, has afforded further information upon this important subject. He says (speaking again of Toulon) "the most noticeable "feature in the Arsenal is the effort made to "prepare rifled ordnance for the navy. Twelve "30-pounders had just arrived, and were waiting to be fitted with locks preparatory to being "sent to the fleet. The system which appears "to be definitely adopted, after repeated experiments, consists of three grooves, about three "inches broad and an eighth of an inch in "depth, with a twist of one-sixth. More guns "of the same kind were being landed on the "quays. From the exertions made to provide "French men-of-war each with a certain number of rifled guns, the question naturally suggests itself whether it is prudent for English "ships to wait until they can be supplied with "Armstrong guns. The immense superiority "of rifled ordnance may be accepted now as an "established fact. Yet so enormous is the demand, that for the protection of English interests I believe many years must elapse before Armstrong guns can be supplied to all "our ships, land batteries and field batteries." He further suggests that it would be a wise precaution to rifle all the smooth-bored guns of small calibre as far as possible.—"It will be a "long time, I apprehend, before the 68-"pounders (solid shot) are superseded, but, "here is no reason why the lighter guns, 32 "and 24-pounders, now supplied to ships should "not be rifled."

Now, with these remarks before us it can scarcely be doubted that the French Government are really preparing to arm a fleet with rifled cannon. Not with a very efficient form of that instrument, it is true, because a mere ordinary service gun with twisted grooves formed in it can scarcely be expected to be so. But the fact to be observed is that, whatever these guns may be, we have nothing of equal efficiency to bring against them. Even if we had a good prospect of getting an early supply of Armstrong guns — which we have not—we could not forget that these are really untried weapons, and weapons which in naval warfare may scarcely be found to suit our purpose. Sailors above all men need have simple instruments to handle, and the Armstrong gun is very far from this. But whether fit for sea service or unfit, reliable or otherwise, we have no Armstrong guns at present. Nor have we any but the old-fashioned smooth-bore cannon to occupy their place. Ought this to be the case? Are we to see armaments of rifled cannon sent on board French fleets, and take no corresponding step ourselves? This we are doing now; but are we to continue thus supine? We put these questions—and we can do no more—with the earnest hope that the necessity for them may speedily cease.

ANCHORS FOR THE ROYAL NAVY.

MR. LINDSAY from his place in Parliament, Mr. Busk in his *Navies of the World*, Mr. Trotman in the *Times* and elsewhere, and many other interested and disinterested gentlemen, are just now doing their best to make us believe that the Admiralty almost deserve impeachment for not adopting the Trotman anchor in the Royal Navy. On the 8th instant, during the debate on the Navy Estimates, Mr. Lindsay informed us that nine years ago he devoted a considerable portion of his time as a member of a committee to inquire into the best description of anchors. Seven anchors were brought, he said, before the committee. They tested them in every possible way, and unanimously arrived at the decision that the Admiralty anchor was the worst of the seven. For nine years that report had been in possession of the Admiralty, and the same description of anchor still continued in use. But, more than that; for 17 anchors, from 20 cwt. to five tons weight, the Admiralty paid £3,434 17s. 6d., whereas the market price of the most eminent firms was only £1,428. "When he found the Admiralty wrong in these "two items, he thought there was great reason "to fear they were wrong in many others, and "that they paid far too much for stores and "materials. Why was it so? The answer "he had received to that question in the matter "of anchors was, that the Admiralty had been "in the habit of dealing with a particular firm. "One firm had a monopoly—and a very nice "monopoly it was for them—at the expense of "the poor taxpayers." Mr. Busk, in his work before-mentioned, tells (curiously enough, considering the ostensible nature of his volume) the same tale as Mr. Lindsay, with even less moderation, introducing it as "a little piece "of Admiralty jobbery," although he afterwards inconsistently "disavows all intention of im-"puting improper motives to the members of "the different Boards of Admiralty." Mr. Trotman himself, in the *Times* of the 13th inst., almost rivals Mr. Busk in his manner of stating the case. The subject is one, therefore, which will bear a little intelligent discussion.

Now, all these gentlemen proceed upon three assumptions: first, that the committee of 1852 were appointed to finally determine by experiment the best of several existing forms of anchor; secondly, that the trials made were amply sufficient for that purpose; and, thirdly, that the Admiralty were bound to adopt throughout the naval service the anchor which the committee pronounced the best. In reference to the first of these assumptions it is necessary to remark that the committee were appointed in deference to the expressed desire of certain private shipowners and others — prompted doubtless by the owners of some of the competing anchors exhibited in the Great Exhibition of 1851—rather than in consequence of any glaring proofs of defect in the Admiralty anchor; in reference to the second assumption it is to be remarked that the committee themselves put forth their report in 1853 with manifest misgivings, carefully inviting a reconsideration of their decisions by others, and furnishing the materials requisite for the purpose; and, in reference to the third assumption, it should be observed that the Admiralty gave no promise whatever to bind themselves to act upon the decision of the committee, who were only appointed, as we have said, in consequence of requisitions urged upon the Admiralty by others.

Nor, we submit—although the Admiralty will not thank us for saying so—were the gentlemen appointed to that committee in any way competent, of themselves, to determine the question submitted to them. Who were they? Admirals Sir Montague Stopford, G.C.B., George R. Munday, and C. Hope; the Master-Attendants of Her Majesty's dockyards at Sheerness and Portsmouth—Mr. J. Aylen and Mr. J. Tonkin; also Mr. W. S. Lindsay, M.P., Mr. Duncan Dunbar, chairman of the General Shipowners' Society: Mr. Anthony Ridley, deputy chairman of the Mercantile Marine Board; and the following members of Lloyd's Committee—Messrs. William Drew, William Phillips, and George Marshall. Very good men most of these doubtless; but in the practical trials of anchors many questions of importance—questions of material, manufacture, &c.—must, or should, have been raised respecting which not one of them was in the least degree competent to pronounce an opinion. The Admiralty were doubtless themselves to blame for the defective constitution of the committee; but that consideration in no way helps us to place our confidence in the results arrived at.

It may suit the purpose of Mr. Trotman and his friends to endeavour to make the decision of this committee binding upon the Admiralty; but sensible men are not apt to deem the reports of such bodies at all times sufficient to authorise great changes. And in this particular case the Admiralty have many—we do not say sufficient—grounds for inaction. In the first place the Report of 1852 has been seriously weakened by the criticism to which it has been subjected by a practical anchor-smith—Mr. George Cotsell, the master smith of Chatham Dockyard. This gentleman, although a servant of the Admiralty, is not to be considered a partizan, for he has more than once been snubbed, and had his writings discountenanced by the Board. Despite of this, however, he has doubtless exerted a strong influence in favour of the Admiralty (or Sir William Parker) anchor, at present in use in the service, and has likewise done much in the way of discrediting the report of the committee of 1852. We cannot here recapitulate all the facts and arguments adduced by him; they can all be seen in an eighteenpenny volume, published by Mr. Weale, of Holborn.

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We may remark, however, that he insists strongly upon the facts that in the trials of 1852, the Admiralty anchor tested was taken at random from a large number, while all the other competing anchors were made specially for the purpose; that the Admiralty anchor was the only one (with one exception) the shank of which did not break; and that the approximate numbers selected by the Committee to represent the relative values of strength, holding power, facility of canting, sweeping, stowing, &c., were most injudiciously selected. Thus, while fifteen marks only were given for the "strength" of the anchor, no less than eighty were given for "holding long and short scope." We do not think with Mr. Cotsell, that the highest value is due to strength; but we certainly believe that this quality is greatly undervalued by the Committee.

Having said thus much, by way of moderating the extravagance of the conclusions to which Mr. Trotman invites the world, we have now to add that he is by no means without reason for urging the gradual adoption of his anchor by the Admiralty. That anchor, although not so far superior to the Admiralty anchor as he would fain have us credit, is unquestionably an excellent instrument, and may be produced at much lower prices than are at present paid for anchors for the royal navy. We do not accept Mr. Lindsay's figures on this point without many reservations; but we do believe the adoption of the Trotman anchor would be a pecuniary advantage to the nation. Certainly Mr. Trotman can do nothing fairer (to all except himself) than he has already done in making the public challenge, which appears in his letter to the *Times*. He says: "That no "doubt may exist in the mind of any one as to "the motives which lead me to decline their "lordships' offer of the 17th of March, I am "willing to submit a Trotman's anchor of 50 "cwt., costing £90, to be tested at my own "risk and cost, against any anchor now in Her "Majesty's dockyard of 100 cwt. or more, the "contract value of which exceeds £365. It "shall sustain a higher proof, possess greater "holding power, and perform in a more effi-"cient manner every duty required in the larger "anchor, such as bringing a ship to, holding on "at long or short scope of cable—in fact, that "it may be subjected to the most severe test pro-"fessional ingenuity can devise, in order to as-"certain the relative qualities and values of the "Admiralty anchor and Trotman's, the latter "being half the weight and one-fourth the cost "of the former." The Admiralty will be wicked and slothful stewards indeed, if they allow this challenge to pass unheeded. The public interest forbids them to do so.

We cannot conclude this article without observing how sadly poor Sir John Pakington has involved himself in this business. Mr. Trotman says:—

> Sir J. Pakington took credit to himself when he stated to the House "that one of his last acts before leaving office was to offer another trial to Mr. Trotman." If, however, their Lordships were indeed serious, and desired only additional proof of superiority, there was the result of the Hon. Captain Denman's experience of more than four years with my anchor on board the Royal yacht; also the testimonies of commanding officers of the Cunard line, the Peninsular and Oriental Company, and the world-wide experience of the mercantile marine, throughout which Trotman's anchor is almost universally used. Last year Sir J. Pakington stated to the House that "he believed the fact was, Trotman's anchors had not been brought into general use on account of the great number of anchors of the old construction which were still in Her Majesty's dockyards." This year his refusal is couched in a new form, and he told the House "he knew nothing of the quality of these anchors from his own personal knowledge, but on consulting practical naval officers the reply he received was that they did not in their experience find them to answer. He was told that Trotman's anchor, when once it could be got to hold, was a good one, but that officers could not rely on its holding." Now, Sir, I solemnly declare there is not and never has been, a single anchor of my construction used in the navy, save the one on which the Royal yacht still depends for her safety. What ground, then, has Sir John for making so grave and so injurious a mis-statement?

When will our affairs be so managed that an excellent but unfortunate Chairman of Quarter Sessions shall not be compelled to speak officially to an assembly of gentlemen upon subjects of which he is totally ignorant? Only conceive, reader, of Sir John Pakington, the representative of Droitwich, rising in the House of Commons to speak—even from hearsay—of the holding properties of Trotman's anchor! We need not wonder that his observations on such a subject fail to bear scrutiny in the columns of the *Times*. Would that some power might save us from such constitutional absurdities—not to say shams!

THE COST OF SHIPBUILDING IN THE ROYAL DOCKYARDS.

CURIOUS facts—not unfamiliar to ourselves, however—have lately been brought forward in illustration of the cost to which the nation is put for shipbuilding in the Royal Dockyards. In that speech of Mr. Lindsay's to which we have already more than once referred, we find these facts put in a connected and striking form. They will bear recapitulation here. It appears that a Return has been made of the cost of a number of ships built in our dockyards, all of the same size—1,462 tons burden. The first of these vessels—the Satellite—was built at Devonport, and the expenditure for shipwrights' labour was in her case said to be £6,450, or at the rate of £4 8s. 3d. per ton. The second, the Pelorus, was also built at Devonport, and the shipwrights' wages were £6,712. The Scylla was built at Sheerness, and the expenditure for the same purpose was £8,621; while in the case of the Racoon, built at Chatham, it was £6,321. The cost of labour in one dockyard was apparently, therefore, much greater than in another. Thus, the Pearl, built at Woolwich, cost us £6 18s. 5d. per ton; while the Satellite built at Devonport, and the Racoon at Chatham, cost £4 6s. 6d. per ton. There must be something radically wrong, said Mr. Lindsay, to cause such a discrepancy as this. Two frigates built in a private yard on the Tyne for the Russian Government—viz., the Tartar and the Cossack—cost £2 8s. per ton. That included not only the cost for shipwrights, but the cost of fitting them out for sea: whereas the entire cost of fitting out the Pearl for sea was £8 13s. 11d. It was evident, to Mr. Lindsay's mind, that there was something wrong in the management of the Royal Dockyards. "Why "could the men not be employed as they were "in private dockyards? If they were employed "on piecework, instead of the labour account of "the shipwrights being £8 13s. 11d. per ton, "it would not be more than £2 12s. per ton. "The rate for labour in the present estimates "was £1,527,000. Of this £1,000,000 at least "was for shipwrights; and on this item alone "there might be a saving of £400,000, while the "work would not be one whit less efficiently "done."

Now, we are not about to blame Mr. Lindsay, by any means, for the part which he has taken in this matter. He is wrong, and in error; but innocently so in this case. If the facts really were as the Return itself makes them appear, his criticism would in the main be sound and pertinent. But the facts are not as they there appear. We know somewhat of the manner in which accounts are kept in the Royal Dockyards, and we unhesitatingly state that it is not possible to get from those accounts what the Return professes to give, viz., the actual amounts of money expended for labour upon particular ships. The Surveyor of the Navy, or his staff, has acted most unwisely, in our judgment, in putting forth such a Return. We entirely deny that its accuracy can be guaranteed.

Let us glance for a moment at the circumstances operating in two neighbouring yards which are contrasted most unfavourably in this return—Sheerness and Chatham. Now, in the latter yard, where there are numerous building slips, by far the larger portion of the shipwrights are constantly engaged upon what is called "new work"—in other words, upon the building of new ships. The interferences occasioned by the pressure of fitting and repairing of ships occur but comparatively seldom. In Sheerness yard, however, the case is wholly different. There is but one small building slip in it; and the regularity of the work expended upon the single ship there building is, of necessity, seriously impaired by the frequent putting on and calling off of hands for repairing and fitting purposes. How this would tell upon the nominal expense of the ship in progress of building will be readily conceived. Like effects are produced in another and somewhat similar way. In the building of a ship upon the stocks, in order that she may be built economically, it is indispensably necessary to adjust the number of hands employed upon her to the varying state of her progress. There are times when less than 100 men, say, are all that can be kept economically at work upon her; there are other times when five times that number may be advantageously employed. Now, in a yard where there are several ships in various stages of advancement simultaneously in progress, this adjustment of hands can be properly attended to. But in a yard like Sheerness, with its one building slip, and an exceedingly fluctuating amount of fitting and repairing to be executed, it is quite impossible to economise the labour in this way. The same remarks apply, to a certain extent, to Woolwich Dockyard. These are the causes which, with others—for we are by no means attempting to treat the subject fully—tend to produce those discrepancies which, by their grossness, have struck the senses of the member for Sunderland. And these are causes, it will be observed, which cannot be removed.

It may occur to some that it would be better to build no ships at yards circumstanced like Sheerness. But this is a mistake; it would be worse. With a ship in progress on the stocks, there is a means of absorbing your spare work in times of slackness, when there is but little fitting or repairing to be done; and although its absorption in this way is undoubtedly attended by a loss, the loss would be greater did this provision not exist.

But when all due allowances are made for facts of this kind, it is useless to look for accuracy to the accounts as they are at present kept. An immense amount of Dockyard labour gets "charged," in the course of months, to wrong vessels. Nor is it, indeed, practicable to avoid this. It is sometimes as impossible to estimate the labour expended upon the building of a particular ship as it would be to measure the work done by the French battalions in the capture of each of the several positions of Solferino, Cavriana, &c., at the last great battle. The mistake lies, as we have said, in the present instance in the putting forth of the Return in question. Far better admit the difficulty than ignore it, and expose yourself to such hard and inexorable critics as Mr. Lindsay.

Mr. Lindsay's remarks upon "piecework" and the cost of shipbuilding in private dock-

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yards, are open to many corrections ; but having dealt with the main question, we must defer the consideration of minor points for the present.

THE FAMILY OF HENRY CORT.

THE scandalous neglect of the Cort family, to which we have so often drawn attention, is beginning to cast a shadow even upon the Queen's Government. A second time the *Times* newspaper, in a leading article, states the facts to the public, and reproaches the nation and its representatives with ingratitude. As the pen of one of the most accomplished barristers of the metropolis—a gentleman eminently qualified by years of special study of the laws regulating property in inventions for discussing this subject—is tracing in our own columns the history of Henry Cort's improvements, we need not enter upon any minute consideration of them. The *Times*, however, in its last article states the leading facts of the case with so much simplicity that we may well repeat here what it says. Briefly, then, the facts are these :—

The family of Henry Cort claims compensation from the British nation for the unjust forfeiture of their father's rights. Henry Cort was the inventor of the process for the conversion of pig-iron into malleable iron by the flame of pit-coal in the puddling furnace. Before his time our ironmasters were compelled to employ charcoal for fuel. Having thus got pig-iron into a malleable condition, Henry Cort invented a further process for drawing it into bars by means of grooved rollers. In other words, he reduced the labour and cost of producing iron to one-twentieth of what they were before his day, and the iron was of a better quality. How, it may be asked, can the children of such a man be in want? How is it they are not among the wealthiest of the land? The answer is this :—Mr. Cort had entered into partnership with a certain Mr. Adam Jellicoe, at the time Deputy-Paymaster of the Navy. Jellicoe advanced money, and was to receive in return half the profits of the trade. Cort assigned to him, besides, his patent rights as collateral security. In the year 1789 Jellicoe died, and was found to be a public defaulter. The Navy Board issued "extents" against the trade effects of Cort and Jellicoe, and confiscated Cort's patent rights, which they treated as valueless. The hardship of the case was this,—a property which should have been estimated at the value of £250,000 was forfeited to insure payment of a debt which the estate would have satisfied seven or eight times over had it been fairly handled. Nobody but the ironmasters profited by this mismanagement, and the Corts were ruined. "It should be emphatically re-"marked," says the *Times*, "that it is not even "suggested Cort had anything to do with Jel-"licoe's defalcations. He was purely the victim "of a swindler ; but, although it might be right "to cause the firm to refund the sums in which "one of the partners stood indebted to the pub-"lic, it was utterly wrong to destroy the noble "fortune which this ingenious man had won by "the force of his intelligence and industry. "England is indebted for a very large share of "her present prosperity to Henry Cort's inven-"tions, but now his four surviving children—"all of them being persons about seventy years "of age—are beggars, and only saved from the "poorhouse by pensions amounting in the ag-"gregate to £90 per annum. There should be "more gratitude in an iron age to the children "of Henry Cort."

All this is what we have substantially said before, and said not altogether in vain. Still, a settlement of the claims of the family has yet to be made. It is for the Queen's ministers now to act in the matter. They are not slow to reward men of their own class. Let us hope they will no longer delay to do simple justice to these aged persons, who, if the creation of enormous wealth gives any claim to competence, are the most conspicuous living symbols of our injustice and ingratitude. We commend the memorial now in the hands of the First Lord of the Treasury to his strong sense and liberal spirit.

[Since the above was written, Mr. W. Fairbairn has nobly offered to subscribe £100 through the editor of the *Times* towards a national subscription in favour of the Cort family. We hope his liberality will be duly imitated.]

CAPTAIN BLAKELY'S IMPROVEMENTS IN CANNON.

THE beautiful theory of great-gun construction which Captain Blakely, R.A., propounded to the world four years ago, and which has been independently conceived and embodied by the inventors of the great Mallet mortar and the Armstrong gun, has lately received strong and unexpected confirmation. Captain Blakely, in our own columns and elsewhere, has argued, in laying down the basis of his system, 1st, that any metal tube pressed on from within must stretch ; 2nd, that in stretching it must become thinner ; 3rd, that, the sides of the tube becoming thinner, the outer parts, particularly of a thick tube like a gun, must be less stretched, therefore less strained, than the inner ; because, to permit of their being as much stretched, the sides would have to become absolutely thicker and the mass of material greater than at first ; 4th, that a tube in which the outer parts are less strained than the inner must be weaker than if all could be equally strained. These principles are so plain, and so manifestly true, that they can scarcely need extraneous recommendation to any mind. Major Wade, of the U.S. Ordnance, has lately, however, made numerous experiments for his Government (who have been so liberal as to publish them, together with many other researches, in a book entitled "Reports of Experiments on Metals for Cannon") which throw much light upon these four propositions. To these experiments Captain Blakely lately drew the attention of the members of the United Service Institution, in a paper* from which we derive the facts that we are about to notice.

In 1846 Major Wade, when testing some muskets by hydrostatic pressure, found the elasticity of sound barrels such that a column of water in them, 21 inches high, could be diminished half an inch by a pressure of 2,000 lbs. A column of water 39 or 40 inches high he shortened $\frac{7}{8}$ of an inch with a pressure of 2,400 lbs. When the pressure was removed the water recovered its original height nearly. This result could not have been owing to the compression of the water, which would have been imperceptible with such a slight pressure ; the musket barrels, therefore, must have increased in diameter during the strain. In 1851 Major Wade measured the change in size of some hollow cast-iron cylinders, when strained from within by hydrostatic pressure. Not only were they all enlarged during the continuance of the pressure, but *in every case an addition of pressure produced an increase of diameter.* He also found that each increase of strain diminished the thickness of the tube. Further, that where the sides were less than one-third of a calibre in thickness, the outer diameter was increased on an average $3\frac{1}{2}$ times less than the inner ; and that in cylinders 2, 3, and 4, where the metal was $\frac{1}{8}$ of a calibre thick, the outside was stretched on an average seven times less than the inside. Thus the first three propositions of Captain Blakely were appropriately verified. Again, in October, 1844, Major Wade burst two 18-pounder cast-iron guns by hydrostatic pressure to find their strength. He afterwards carefully tested the strength of the metal to resist a direct tensile strain. One of these guns burst with a pressure of 9,000 lbs. per inch of resisting metal, yet a sample bar of the gun showed a strength of 27,350 lbs. per inch. The other burst with a strain of 6,082 lbs. per inch, whereas the sample showed a tensile force of 22,204 lbs. Here we have proof that some part of the metal did not exert its strength, and that in each of these guns at least the useless part amounted to the great proportion of more than two-thirds of the whole. In his report to the Colonel of Ordnance at Washington Major Wade wrote on the subject as follows :—"The relation between "the force applied in producing a fracture in "cast-iron by a tensile strain in the axis of the "specimen, and by that of hydrostatic pressure "within the bore, appears to be somewhat "greater than as three to one." Another experiment made by Major Wade a few weeks later showed that it is the outside parts of cylinders which do not exert their strength. He turned down the outside of a 6-pounder cast-iron gun in a lathe to such an extent as to form, from the breech near to the trunnions, a cylinder of the uniform thickness of one calibre, that is to say, with a thickness of metal on every side equal to the diameter of the bore. He cut off the trunnions, and turned a second cylindrical portion in the middle of the gun with the thickness of half a calibre. In front he formed a third cylinder with metal only one quarter of a calibre thick. With a hydrostatic pressure of 12,400 lbs. per square inch, the thin part burst in four fissures. The piston was then inserted in the middle part where the metal was half a calibre thick, and a pressure of 20,000 lbs. burst it in three fissures, one of which extended 16 inches into the thick cylinder. In his report Major Wade wrote as follows :—"It appears from these results, that the "power of resisting in cylinders of the same "quality of iron, and of the same diameters of "bore, but of different thickness, varies as the "thickness, but in a less ratio. Hence the in-"crease or the diminution of the thickness of "iron in a gun does not increase or diminish "the strength in like proportion." From a table which he gives we see that a 6-pounder, when only one-fourth of a calibre thick, required a pressure of 12,400 lbs. per inch of bore to burst it ; but that with double the thickness of metal, an addition of only 7,600 lbs. pressure, or about five-eighths of the former, sufficed to destroy it. The second equal thickness of metal, then, only exerted five-eighths as much power as the inner, the total strength being less than if they had been equally strained. "Although these experiments would by them-"selves," says Captain Blakely, "be insufficient "to establish a theory, and although I was un-"able by reasoning, founded on pure science, to "convince many persons of the soundness of "my views, still I trust that the mutual corro-"boration of argument and experiment will "have greater effect. Here, in England, an "opinion is expressed, that for certain reasons, "cylinders if strained would stretch, and "stretch more inside than outside ; in America "a number of cylinders are measured during "strain, and without exception all do stretch "with every increase of strain, and all do "stretch more inside than outside. This cer-"tainly makes it appear probable that the "reasoning on which the opinion is founded is

* Published in the last No. of the *Journal* of the Institution.

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"correct, and that all cylinders would follow "this law."

In the case of iron tubes, an experiment which any one can make is decisive as to the stretching. A leaden ring fitted on such a tube will stretch with it when strained, but will remain enlarged when the iron is permitted to regain its original size. Mr. Greener, of Birmingham, made a series of experiments with the barrel of a fowling-piece, having leaden rings at intervals on it, for the purpose of showing how much each part was enlarged during the discharge of the piece. Where he found this enlargement less than at other parts he concluded that the barrel was stronger than necessary, and modelled the next he made accordingly. The enlargement of tubes when pressed on from within, being thus proved beyond the possibility of doubt, the simultaneous diminution in the thickness of their sides will be readily admitted. "No person could expect a ring which fitted a "little finger to be enlarged to fit a first finger "without becoming thinner," as Capt. Blakely says; and as any thick cylinder or tube may be considered as composed of several concentric smaller ones, it is evident that each of these, by becoming thinner when stretched, loses some of its power of pressing the one above it. Here we have the whole of the very important theory of this able officer.

The method of constructing cannon which he advocates in accordance with it is, then, simply to form such parts of them as require great strength of concentric tubes, each slightly too small to go over the one below it without force; *the amount of this difference in size being so regulated that with a certain amount of pressure each tube shall be equally strained*, or that the outside (which can be replaced if broken) shall be most strained. One of these tubes should extend the entire length of the gun, the others may be formed of more convenient sizes. We really should like to see this system put into general practice. Its value can scarcely be over-estimated.

Captain Blakely honestly informs us that from the "Reports of Experiments on Metals "for Cannon," he learns he is not the first person who proposed a remedy for the unequal straining of the parts of a gun. In 1851 Lieutenant Rodman of the United States Ordnance proposed, for that purpose, to cast guns hollow and cool them from within. On the 30th July of that year, at his suggestion an eight-inch gun was cast hollow by means of a core formed on a tube of cast-iron. Through this a stream of water was kept circulating until the gun was cool. By this means, Mr. Rodman made the inside solidify first. The next layer solidified, of course, at a greater temperature than that of the extreme inside at that moment, as this had already had a short time to cool and contract. Had the outside of the gun been kept liquid until all the rest had gradually become solid, giving out all heat through the core only, doubtless the gun would have been in a condition very nearly approaching that required by theory, so far as the initial tension on the external portions is concerned. As it was, the gun was much stronger than another cast solid at the same time, of the same size, and of the same metal. The latter burst after 73 rounds with 10 pounds of powder and one 64-pound shot; that cast hollow was fired 1,500 times with the same charge and is still sound. On the 21st August, 1851, two ten-inch guns were cast at New York from the same metal, one solid and one hollow. The latter was cooled from within like the eight-inch gun, but the outside was also allowed to cool, though more slowly. These guns were proved by repeated firing with 18 lbs. of gunpowder and one 124 lb. shot. The gun cast solid burst at the twentieth round, the other stood 249 rounds. When examined afterwards, the gun cast hollow was found to be, in one part, fissured, the outside and inside having solidified before the middle. It is probable that even where no absolute fissure was found, the portion of metal intermediate between the two cooling surfaces was less dense than it should have been.

Captain Blakely does ample justice to Mr. Rodman's invention, but deems his own plan the better. "One advantage my plan certainly "has," he says: "I can use, to obtain the "greater part of the resistance required, a metal "much stronger than cast iron, while retaining "that metal for the interior of the tube, for "which part it is so suited; thus securing the "hardness and inflexibility of cast-iron, and the "tensile force of the toughest steel. Wire even, "the strongest form of iron or steel, can be used "with great advantage in some cases. The "saving in size of guns, therefore, in expense of "transport would be enormous. This is, how-"ever, a very small matter, in my opinion, com-"pared to the advantage of, by this means, "being enabled to make cannon of a size and "strength hitherto impossible, and still impos-"sible by any means which do not ensure that "each part shall do its work. Nothing would "be so conducive to peace as arming the vul-"nerable parts of every coast with guns so "powerful that one or two shells from them "could destroy a ship. Few have any idea "how inadequate to the end desired are the "means often employed."

On another page we give a most interesting account of Captain Blakely's development of his invention, in his own language.

THE CASE OF HENRY CORT,

AND

HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

No. VI.

THE puddling process as described in the specification of Cort's second patent, with or without the working of the iron by the grooved rollers, was an improvement in the manufacture of bar from cast iron; the piling, faggoting, and heating of the iron in a hot-air furnace instead of a hollow fire under blast, and the working and welding of bar iron by the grooved rollers was an improvement in the application of bar iron, however made, to the purposes for which that material was required. The uses from iron made by the ordinary process, when piled, faggoted, and worked as described, were much better than had ever before been made of British iron; but such uses made of puddled iron, worked, piled, faggoted and rolled according to the complete invention, were equal to those theretofore made of foreign iron only; thus the home was placed upon an equality with the foreign manufacture.

Cort would appear to have freely invited the manufacturers of iron, of scientific persons, and of others interested in the subject at a very early stage of his discoveries. The following extract from a letter from the celebrated Watt to the equally celebrated Dr. Black, will be read with much interest. It bears date the 6th of June, 1784, that is, just after the specification of the first, and before the specification of the second patent:—

"Birmingham, June 6th, 1784.

"Previous to your letter I had heard much of Mr. Cort's process for making bars, and have seen a great deal of his iron; though I cannot perfectly agree with you as to its goodness, yet there is much ingenuity in the idea of forming the bars in that manner, which is the only part of his process which has any pretensions to novelty. The kind of iron you describe is one of the modifications of cold short iron, and is known here by the emphatical name of *rotten-tough*. I have long known that almost any cold short iron may be brought to that state by rolling it very hot, or by drawing it across the anvil so as to spin the crystals into threads; and, by certain mechanical processes, good iron may be rendered cold short. Nevertheless in neither of these cases is the quality of the iron altered; the good iron continues strong, and the cold short is very weak. I look on Mr. Cort's iron as a cold short, whose crystals are spun out by the rolling, and which is mixed with a large quantity of half metallised earth. It is tender to the file, and soft to the hammer, rusts very readily, and ought never to be used where it is subjected to any strain, as it is very weak, therefore unfit for engine work, ship work, &c., but good for nails, because easily wrought: but then the nailors complain that it wastes more than the common cold short, I suppose because not so well freed from its cinder. I speak only of the iron made from cold short by this process. Good iron is hard under the hammer and stubborn to the chisel and file, breaks white, generally granulated, but the very best is fibrous, and white like silver. I find I am getting into a dissertation on iron which I must shorten. Mr. Cort has, as you observe, been most illiberally treated by the trade; they are ignorant brutes: but he exposed himself to it by exposing his process to them before it was perfect; and they saw his ignorance of the common operations of making iron, laughed at and despised him; yet they will contrive by some dirty evasion to use his process, or such parts as they like, without acknowledging him in it. I shall be glad to be able to be of any use to him."*

The iron referred to in this letter, both from the terms employed and from the period of the trials seen by Watt, must have been ordinary bar iron subjected to the treatment described in the specification of the first patent. The omission of all reference to the puddling process is conclusive on this point. The sympathy of Watt, then struggling with the opposition and difficulty of introducing the inventions the subject of his patent dated 5th January, 1769, and involved in litigation with those who sought to evade the moderate payment of a small portion of the saving which the immortal genius of the inventor had conferred upon them, must furnish an excuse for the severity of the language of a portion of that letter, and of the strictures upon persons who have shown no indisposition as a body to give due credit to Cort, though the sequel will show how much there is to justify the most severe censure on the indifference with which the nation has treated the family of one of its greatest benefactors. This letter is important as showing the attention which Cort's discoveries had then received from two of the most eminent men of the time.

The invention of Cort, as disclosed by the specifications of his two patents, taken out within thirteen months of each other, is puddling, piling, and faggoting, and heating in an air furnace, and working by grooved rollers; the air or reverberatory furnace was furnished with a hollow bottom, suitable for receiving the fluid mass and permitting it to be worked. This furnace was employed instead of the ordinary finery furnace theretofore used. Much has been said in the course of the controversy in this case respecting the construction of the furnace, the substitution of iron or cinder for sand

* See "Extracts from Mr. Watt's Correspondence," in the work entitled "Mechanical Inventions by James Watt, by Muirhead," Vol. II., p. 189.

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bottoms in the puddling furnace, these and other subsequent improvements contributing to the certainty, perfection, and cheapness of the result are additions to, and in no respect detractions from the merit of Cort, who was the first to place the British in a position to compete with the foreign manufacturer.

The letter of Watt to Dr. Black is the earliest account that has been preserved of a cotemporary on the subject of Cort's inventions. The following letter from Alexander Raby, who had been in the iron trade between forty and fifty years, and well acquainted with its manufacture at least twenty years prior to Cort's inventions, will be read with interest; though not written for many years afterwards. It was addressed to Mr. Coningsby Cort on the occasion of the inquiry by the Parliamentary Committee, in 1812, into the merits of Cort's inventions :—

"Llanelly, June 20, 1812.

"DEAR SIR,—I have received your letter of the 15th past. What I said to Mr. Giddy and Mr. Maddox upon your father's mode of making bar iron, I have not the least objection to state in writing.

"I was in the habit of intimacy with your father several years before he began his puddling system for making bar iron, and when he began it, and after he had used it some time, I was still of the unbelieving tribe, that thought it would never come to anything. I expressed myself so both publicly and privately at that time, and I may venture to say most other people in the iron trade thought of it as I did, and I am sure no man thought well enough of it for a long time after to claim the merit of the invention, nor was it thought of otherwise till your father, by his perseverance, had so far furthered the plan by producing most expeditiously large quantities of bar iron by working it in grooved rollers after being puddled, instead of under hammers, which invention of rolling bars was also entirely new and his own. Attempts had been made to roll round iron in hollows turned in rollers, but never to roll bar iron in grooved roll, which is very different, as round iron is not rolled in grooves, but in loose semicircles. No man, I think, will attempt to say he was the inventor of rolling bar iron in grooves, or to prove your father was not.

"Unbelieving as I was, I soon became a convert to his mode of puddling and rolling bar iron both as to quantity and quality. Some improvements soon also took place by first refining the pigs or cast iron before they puddled it, but it was obliged to be puddled before it was made into bars; nor could their refined metal be worked to profit or with expedition by any other mode than by puddling. I will venture to say that owing to that system and the use of grooved rolls, this kingdom is indebted for its present proud state of the iron trade, when instead of being obliged to bow down to the north of Europe for a scanty supply of that useful article at a very high price, we are enabled to supply all our own wants with an immense annual saving to the country. But was not only all Europe, but all the world to depend upon us for bar iron, Great Britain would be able to supply the whole, both good and cheap. And to whom is all this grand improvement and national benefit owing? and with whom did it originate but with your father? Envious persons may want to pervert the merit that is due to him, but when I recollect the trouble, pains, and expense he was at to make converts, so as to increase the quantity made by his mode when he was himself convinced of its utility, and the premium some great men then in the iron trade were in consequence thereof willing to pay for the use of his patent, surely that alone is sufficient to prove the inventions were his own. I can only add, I am happy to be called upon to pay this small tribute to your father's memory, to whom I consider this kingdom, the world at large, and the iron trade in particular, greatly indebted.

"(Signed) ALEXANDER RABY."

The partner and associate with Cort in the business at Fontley, Adam Jellicoe, was, as appears by an agreement dated the 8th of Jan., 1781, entitled to one-half the premises, &c., on paying half the cost and one-half of all contracts and stock-in-trade, at a price to be settled by arbitration, and in consideration of finding the necessary capital was to participate equally in the profits of the trade. It appears that Cort advanced £20,000, and Jellicoe £27,500 on the Fontley business. In one respect Cort was more fortunate than many of his class; the practical instinct and indomitable perseverance, the characteristics of his inventive genius, were not smothered by the want of pecuniary means to demonstrate the truth of his speculations. The manufacture by his process from the commonest description of cast iron of iron equal and superior to the best qualities of foreign iron became an established and admitted fact. Immediately after the date of his second patent, Cort was able to obtain the ear and command the attention of the public departments to his invention, which in 1785 and 1786 was made the subject of trials in the dockyards of Portsmouth, Deptford, Woolwich, Sheerness, Chatham, and Plymouth. The result of these trials was published in 1787, accompanied by a statement of facts authenticated by the authority of Lord Sheffield, Dr. Joseph Black, and David Hartley.

The following extracts from original documents which have been preserved, and from the printed statement so authenticated, will be read with interest :—

"Navy Office, 13th June, 1783.

"Messrs. CORT AND JELLICOE,—In return to your letter of yesterday requesting that directions may be given to inspect the nature of your new-invented method of working iron, acquaint you that we have directed some of Portsmouth officers with the master-smith to proceed to the works and report fully their opinion.

(Signed) "CHAS. MIDDLETON,
"J. WILLIAMS,
"GEO. ROGERS."

"Portsmouth Dock, 7th July, 1783.

"HONOURABLE SIRS,—In obedience to your directions of the 13th post, in consequence of a letter from Messrs. Cort and Jellicoe, requesting directions may be given to inspect the nature of their new-invented method of preparing, welding, and working various sorts of iron, that the master-shipwright and his first assistant, with the storekeeper and master-smith, should proceed to the works and thoroughly examine the process they make use of, and report fully their opinion thereon, returning the enclosed with their answer.

"In answer, pray leave to acquaint you that we have been to Messrs. Cort and Jellicoe's mills at Fontley, and thoroughly examined the process they make use of in preparing, welding, and working various sorts of iron, which they do by putting the iron designed to be worked into an air furnace, where it remains until it is so hot as to be between a welding and a fluid state, when it is either worked under a forge-hammer of 7 or 8 cwt. or passed between two rollers of about 9 cwt. each, which immediately and very visibly destroys the greatest part of the dross and impurities from the said iron, and if required will also weld two bars together at the same time, as well as bring the most brittle iron into a malleable and tough state by the above process, equal to the best Orground iron, which we flatter ourselves will be clearly investigated by the following experiments :—

"By putting a piece of the best Orground iron, marked (*L*), of nine pounds weight into the air furnace, and when so hot as above described took out and passed between the rollers, whose pressure is such as to discharge the greatest part of the dross and impurities from the said iron; for on weighing it after it had passed through the above process we found it weighed only 8¾ lbs., so that it discharged ¼ of a pound in nine.

"We also tried three other pieces of iron of the different weights and qualities by the above process, whith are as follows, viz., a piece of the 2nd sort of iron of 9 lbs., which on weighing after it had passed the above process weighed only 6¾ lbs., so that it discharged 2¼ lbs.; a piece of the 3rd sort of 5¼ lbs. weighed after passing the above process, only 3½ lbs.; a piece of very bad iron of 4½ lbs. weighed after passing the above process only 2½ lbs.; by which it appears that the dross discharged by this process is in proportion to the goodness of the several sorts of iron; and by every trial we made, as far as we could discover by the different discharges of the dross and impurities from the different sorts of iron, it all became equally pure to any iron that can be manufactured. We also had some faggots of old iron hoops, and of the smallest sort of Birstrel iron put into the air-furnace and worked under a forge-hammer of 7 or 8 cwt., which welded it so entirely as to make it perfectly one solid body, and at the same time also discharged the greatest part of the dross, which we proved by passing it afterwards between the rollers and slitting into hoops, and another piece into bars of a half-inch square, and then drawing into bolt staves, which was very good. We also made a tackle-hook from some of the same iron, and put it cold under the forge-hammer, which did not break it. We are therefore humbly of opinion, from the many experiments we have made both from old and Birstrel iron, &c., when properly manufactured, as set forth on the other side, by being heated to a proper heat in the air-furnace and worked under the rollers or forge-hammers as therein described, is very proper iron for making mooring-chains, bolt-staves, tackle-hooks, &c., &c., &c., or any other uses it may be wanted, for this or any of His Majesty's yards.

"We had also two links of large mooring-chains drawn from the air furnace, under the forge-hammer, which we found to be quite solid and much tougher than those made from the common forge; and herewith we return Messrs. Cort and Jellicoe's letter, which being submitted,

"We remain, Honourable Sirs,
"Your most obedient Servants,

"(Signed) GEO. WHITE, WM. RULE,
"J. BADCOCK, J. GREENWAY."

Other letters and communications passed about the same time in reference to the trials, which established conclusively to the satisfaction of the authorities the superiority of the iron made according to Cort's processes of manufacture.

LIST OF NEW BOOKS.

Busk's the Rifle and How to Use it, 4th edition, 2s. 6d.
Cassell's Natural History: the Monkey Tribe, 2s.
Fairholt's Tobacco, its History and Associations, 9s.
Newth's Mathematical Examples, 8s. 6d.
Our Farm of Four Acres, 4th edition, 2s.
Routledge's Natural History, by Wood, div. 1, 4s.
Russell's Rifle Clubs and Volunteer Corps, 1s. 6d.

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THE GLOBE TELEGRAPH.

IN a late number a review was given of Mr. Beardmore's pamphlet upon "The Globe Telegraph," under which title was proposed a system of electro-telegraphic communication, which bids fair to solve the difficulties which attend the transmission of signals in long submarine wires. To most of our professional readers these difficulties, and the method by which it is now shown they may, in all probability, be overcome, are already familiar; but we think it necessary, in order that the general reader may be *au courant* with a subject involving, perhaps, the very possibility of successfully establishing a telegraphic link between the Old World and the New, to give a brief *apergu* of this plan, and of the advantages said to be derived from it.

The galvanic arrangement employed by the patentees of the "Globe Telegraph" consists simply of the "two dissimilar metals" with which Subzar experimented, and the effect of which in contact was (some fifty years afterwards), investigated by Galvani, and made the subject of a science by Volta. The battery arrangement discovered by the latter philosopher in his *Couranne de Tasses*, consisting of a series of alternations of dissimilar metals contained in separate vessels, and connected one with the other by a metallic wire, is relinquished for a single couple, the amount of surface of which is regulated according to the distance between the metals; and the wire, by means of which a metallic connection is established between, then becomes the medium through which the current is rendered available.

By increasing the number of the galvanic couples, and by immersing them in an active chemical agent, Volta was enabled to obtain the energetic action due to what is termed "tension" electricity. By "tension," in opposition to "quantity," is understood that property by which an electric current produces in a higher degree the effects of muscular disturbance in animal bodies, and of electro-chemical decomposition in inorganic compounds. But it is by no means necessary that this property should exist in any high degree for the production of those phenomena on which depends the transmission of electric signals, and, on the other hand, it is now evident that the employment of high tension electricity is productive of serious disadvantages as regards "induced currents" and the loss of electricity. The usual electric signal consists in the deflection of a magnetic needle; and this deflection may be produced with a current of very low tension by means of a *short* coil of a *thick* wire, upon which the ordinary telegraphic current would produce a scarcely perceptible effect. This being the case, the employment of tension electricity, with *long* coils of *five* wire, offering a considerable resistance to the circuit, certainly appears anomalous; and the substitution of the contrary conditions would be a step in advance in the art of electro-telegraphy.

But the current produced by the simple galvanic couple possesses an important advantage over any other "quantity" arrangement, insomuch as the electricity has no tendency to escape through the earth from an imperfectly insulated wire. In the proposed arrangement any deficiency of insulation can only interfere with the transmission of the current by causing the wire to act as a voltaic velement, neutralising to a greater or less extent the available electricity of the plates. The importance of this consideration becomes obvious when we take into account the enormous loss of power which must occur in submarine circuits, where the imperfectly insulating covering of the wire is exposed to the constant action of high-tension electricity.

In April of the present year a trial of the new system was made between Guernsey and Southampton, in which, with single plates of zinc and copper, 110 miles apart, and less than three square feet in size, sufficient electro-motive force was obtained to work a Siemens instrument. Little attention appears to have been directed to this experiment, which we would now offer for the consideration of those who were present at the reading of Mr. Varley's paper at the Society of Arts in March last, under the impression that it might throw some new light upon the difficulties of submarine telegraphy.

MONEY-MAKING AT THE ROYAL MINT.

No. VII.

IN order to make our explanation of the mode of getting up medals yet more clear and explicit it must be stated that there are two machines employed at the Mint for lettering, after they are struck, the edges of those badges of honourable distinction. These machines are so constructed as to indent, by the aid of small steel type, the rank, name, and ship, or regiment of each person destined to receive a medal, upon its edges. As may be imagined, this operation is a tedious one, and when many have to be lettered in a comparatively short space of time, a compositor from an ordinary printing office is engaged on the duty. In the case of the Crimean medals—of which we believe, so indiscriminately were they bestowed upon English, French, Sardinian, and Turkish soldiers and others, 400,000 were distributed—it was found impossible to letter more than a select few. It would have been exceedingly difficult to collect the names of the motley host which comprised the allied forces, and more difficult, perhaps, to decipher those names, or find space for them with the other particulars, and the clips, upon the limited circumference of the medal. Officers and men, however, of the British Naval and Military Services had the privilege allowed them of returning, through the Admiralty or the War Office, their medals to the Mint for the purpose of having their names, &c., impressed upon them, and many, we believe, availed themselves of the opportunity.

The machines for effecting the object are small, and worked by hand. In one the medals may be lettered *after* the clips have been attached, and in the other *before*. In the first the medal is put into the machine vertically, and the type is made to travel underneath it; in the second, which is that usually employed, and which we shall therefore more fully describe, the medal is placed horizontally in the machine, and made to revolve against the type. This machine consists of a firm oaken bed, supported on four legs, and fitted with a hand-wheel and crank, calculated to give to a square horizontal bar of iron working in a planed groove a travel of some six inches. Parallel with this iron bar, which rises to perhaps ¾ of an inch above the groove, and to one side of which is attached a boxwood cheek—parallel with this is a stationary recess for holding the type case. Between the cheek and the type case there is a space slightly less than the diameter of the medal. Within this space the medals, flatly laid, receive their indentations. The compositor, sitting at a table beside the machine, with his war office or Admiralty "copy" before him, and his alphabetically-arranged type near at hand, has set up in the little case, about 4 inches in length, say the name of "Serjeant Major John Jackson, 60th Rifles," or of "Admiral Sir Charles Napier, H.M.S. Undaunted." Well, he next carefully places the case, which is quite straight, and allows the letters to project equally throughout, in the machine, and lays the medal in the space alluded to. He now puts his hand to the wheel, and turns it until the sliding bar advances with its wooden cheek, and the latter catches the edge of the medal. Continuing now, per wheel, the forward pressure, the medal is made to revolve in front of the steel letters, and to take from them the requisite inscription. After passing beyond the case of the type the medal is necessarily released, and if on examination found free from error or imperfection, is placed in a numbered envelope, and for the present set aside. Mr. Compositor now looks to the next name on his list, re-sets the type in accordance therewith, and repeats the operation as described, and to be continued until the list is completed; but it is unavoidably a slow process.

The Mint may at this stage be said to wash its hands of medals, for they are despatched after lettering to the Horse Guards or the Admiralty, and thence to the court jewellers, Messrs. Hunt and Roskell, to be further fitted with clips, ribands, and clasps, one of the latter, indeed, being given for each important action in which its recipient may have been engaged. The jewellers return them to the Government office, to which they pertain, and soon they are seen decorating the breasts of those who have nobly earned them. Besides the general medals given for the Kaffir, the Russian, the Persian, and the Indian wars, there are occasionally struck and distributed particular decorations for "meritorious service," "distinguished conduct in the field," and for "long service and good conduct." The medals in all cases are of the same intrinsic value, weight, and material, namely, 5s. 6d., one ounce, and of fine silver. The mountings, labour, &c., make them cost the State, however, about eight shillings each.

Thus much on medals; now let us revert to a process intimately connected with money and medal making—that of the conversion of square bars of cast steel into dies. Without these no legitimate coining can go on, whatever the ladle and mould, in an illegitimate sense, may accomplish "down Whitechapel way." All the dies used in the Royal Mint are made in that establishment, and it would be improper to conclude our series of papers on money-making without allusion to the manner in which they are manufactured. The bars of steel intended for conversion into coining dies, are selected from the very finest that can be produced. The Messrs. Turton, of Sheffield, have obtained honourable mention for the rare quality of the article for the especial purpose which they have supplied. A much larger per-centage of coins are obtained, we are credibly informed, from dies made of their steel, than from those got up from any other. Supposing that we were about to carry out the decimal system of coinage as shadowed forth lately in our own columns, and that the engraver of the Royal Mint had received instructions to prepare designs and get up dies for the one or two new coins which would thus become necessary, he would commence his important duty much after the following fashion :—

With pencil, paper, and compasses, he would take the initiatory step, that of sketching the obverse and reverse of the coin—say the cent, for example. Having satisfied himself upon the proportions, devices, and inscription of the embryo pieces, the engraver would next obtain a piece of steel cut from a square bar, of the best quality, forged into the cylindrical forms of the proper dimensions, faced in the lathe, and in a soft state. To the faced ends of this he would transfer with pointed gravers the design determined on. The next operation would be to commence engraving that design on the surface of the steel with small tools prepared for the purpose. After, as may be supposed, a very considerable amount of sedentary and tedious labour, and no ordinary exertion of patience, there appears upon the surface of the steel a very perfect copy in *intaglio* of the original design. Repeated impressions taken from this in clay of a peculiar nature and colour—hard and

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grayish white—enable the worker to test the finish of his work and to examine the fineness of his lines and the general effect they are likely to produce as a coin. Satisfied at length that all is well, and that retouchings would be but to "paint the lily," the engraver gets all superfluous steel turned off in the lathe, and the diameter and height of this *matrix*, as it is now called, made precisely what he wishes them to be. Then comes a delicate and exceedingly important task—that of hardening—and here practical difficulties arise which, if not successfully overcome, may mar all his previous labours.

Above all things, the engraved face of the *matrix* must be protected from the action of fire or water. In order to accomplish this protection various substances have been employed; but mixed oil and lamp black answers pretty well. This composition, in proper proportions to form a paste, is spread thinly over the engraved work of the *matrix*, which is next placed face downwards, and surrounded by powdered animal charcoal. It is heated to a particular temperature, and then plunged into cold water. In this it is kept, held by a pair of tongs, in a state of agitation until all ebullition ceases. Much of the art of die-hardening depends on practice, and nothing short of extensive practice and a perfect knowledge of the chemical and mechanical properties of the steel to be dealt with can qualify workmen for the duty. Constant practice in the same round of operations at the Mint no doubt ensures success in almost all cases of hardening. We will suppose that it has so resulted in the case of our imaginary cent *matrix*, which the engraver, after tempering, pronounces to be good and serviceable. His next want is that of a "*punch*"—not a copy of our facetious friend over the way—but a steel punch. In order to obtain this, another piece of the same steel bar which has so far "worked" well is cut off, forged, turned, and prepared. Instead of having this will-be *punch* turned flatly on the end, it is made flatly conical, the apex being a point. With this point uppermost the piece of softened steel is now placed on the solid bed of a heavy press, to be worked by hand, though having its screw and fly-arms so arranged as that they be made to take three or four complete revolutions upwards, and then be thrown down with great momentum. The *matrix*, like the upper die in the coining press, is fastened to the screw of the press, and as all is ready for the next stage of die-making, we may suppose that the workmen have raised the screw and *matrix* to the required height. All is adjusted below, and the fly-arms released spin round with great and increasing velocity until the engraved face of the *matrix* meets in violent contact the apex or point of the *punch*, and you might suppose that the engraver's work was marred by the blow. Now the press rebounds, the workmen catch the fly-arms, and on examining the *matrix* you find it none the worse. The punch shows the valuable effect of the concussion, however, in having obtained to some extent, if not completely, a faithful copy in relief of the engraved matrix. This latter may now indeed be laid aside, its mission for the present being ended. The *punch* has, however, to be passed through the ordeal of hardening before becoming ready for its arduous task of giving impression to thousands, and it may be tens of thousands of money-making dies. The hardening and tempering in this instance are performed in a manner precisely similar to that described above, and at the Mint failures are extremely rare. The punches for both obverse and reverse sides of a coin are prepared in the same way, and once these are perfectly struck, hardened, tempered, and, perhaps, retouched by the engraver, they are in a condition to allow dies to be multiplied from them almost *ad infinitum*. Pieces of steel are now cut from the bar and forged to the circular form, then turned flatly conical on one end, softened to the lowest point, and sent forward to the *die multiplying press*. Here they are placed one by one on the bed of the press and underneath the *punch*, which is made to strike them with all the accumulated force of sundry revolutions of the weighted screw, if the dies are of large size, and with modified intensity if the dies are small. Repeated thumpings transfer the relief engraving of the punch to the turned end of the die, which perhaps, too, will require one or two annealings before getting an *intaglio* impression perfectly representing the device of the punch. This, however, being accomplished satisfactorily in a number of cases, a batch is sent off to the die-turning shop. This is fitted with several lathes—it must be admitted rather antiquated—in which the superfluous steel is turned off and the dies made of the proper diameter, height, and shape for fitting the die holders of the coining presses. Next they are hardened, then their faces are polished by being held against a rapidly-running disc of iron, and lastly, they are brought by tempering to a colour very much resembling the hue of our southern corn-fields at this hour—a "*dark* straw." The average number of coins which a pair of dies should produce is 30,000, and more ought not to be struck from them. The dies for medals are got up in a manner closely resembling that in which coining dies are prepared, but of course from their larger size and bolder engraving, they give in every stage of manufacture more trouble.

It may be said, too, that in the engraver's department at the Royal Mint there is a machine, which we have seen, for copying, on a larger or smaller scale, an engraved device of any sort; for instance, supposing that, by some unhappy dispensation of Providence, a new monarch had succeeded to the throne of these realms, it would become necessary to issue a new set of coins, from the sovereign downwards. Well, then, by aid of the copying machine in question, which is of delicate construction and very perfect in its details, the engraver, after designing and engraving *one* obverse of large size, would be enabled to produce a series of small copies in steel down to the threepenny-piece size. At one end of the machine he would fix his engraved die, and at the other a plain piece of steel. By means of a treadle he would put both these in motion. He would next cause a steel pin fastened at right angles to a square bar of iron, having a moveable fulcrum, to be brought forward to the engraved surface he wishes to copy. This pin is kept up to its work by means of a weight and lever. At the other end of the iron bar, which is placed parallel with the front of the machine, would be fixed a small cutting tool. This would, therefore, when the machine was kept in motion, cut from the surface of the softened piece of steel just as much metal as the pin traversing over the whole engraved face of the die at the other end would allow; and, in fact, would *copy* it, on either a larger or smaller scale, in proportion to the distances of the fulcrum from the cutting-tool and the guide-pin. The coinage of King William IV. is remarkable for the accurate profile of His Majesty upon all the pieces of money comprising it. The copying machine here referred to may be thanked for preserving so closely the lineaments of the monarch. Mr. W. Wyon copied and engraved from a life-like bust by Chantry the head for the William IV. half-crown, and all the other dies for the coinage were the work of the copying machine. Those who have not compared the coins of the various denominations of this reign with each other may well do so—microscopically, or otherwise—and they cannot fail to observe their *vraisemblance*. Attached to the die department of the Royal Mint there is a die museum, of the contents of which a carefully-arranged chronological catalogue in MSS. exists. Visitors, on application, are allowed to inspect the contents of this numismatically interesting apartment. The oldest die in the place is of the date 1272, and it is a rare specimen of the art of engraving at that remote era. The *Simon* petition crown die is among the curiosities of the die museum of the Mint; but to catalogue all the specimens of this species of manufacture on its shelves would be to absorb an amount of space which cannot be spared.

It is hoped that the main points in the art of Money-making, Medal-striking, and Die-manufacturing have been revealed to the public through our pages with sufficient clearness, and that our labour in the preparation of the series of papers on these subjects—of which this is the last—has not been labour lost.

As it is possible that some of our readers may require to put the machinery of the Mint in motion on their own accounts some day, we may tell them that in order to do so they are only required to be possessed of £10,000 worth of gold, and to observe the following (abstract of) regulations:—

1st. The Mint receives gold bullion for coinage on Tuesdays, Thursdays, and Saturdays, from 12 to 2.

2nd. Any persons intending to deliver gold into the Mint for coinage must give a week's notice of their intention by letter addressed to the Master of the Mint.

3rd. Before delivery, the person delivering the bullion must make a written statement in duplicate on forms supplied to him at the Mint, of the marks of each ingot, the "report" thereon of the assayer, upon whose assay he purchased it, and the name of that assayer.

4th. All the regulations with regard to weighing through Mint office scales, entries of weights, &c., as described in our account previously published of receipt of bullion from the Bank, must be attended to.

5th. A new assay by Mint assayer, and comparisons, with report of private assayer, necessary.

6th. The bullion must not be brittle.

7th. Arbitration, if the assayers differ as to the "betterness" or "worseness" of the bullion.

8th. On the completion of the coin notice shall be sent to the importer, and a time fixed for its delivery to him, when the same weight in gold coins at the standard weight at which the ingots were received will be delivered to him *without any charge whatever!*

The ninth and last clause of these regulations—which are not, for obvious reasons, given *in extenso*, but which we shall be happy to supply to any would-be coiner—the ninth clause is the most important, because it demonstrates that gold coinages are executed at the public expense. Some member of the Rothschild family was, we believe, the only private individual who has had the honour and profit of working the Mint machinery as yet.

Now, as regards the means of gaining admission to the Royal Mint for the purpose of viewing the operations going on there, and of which it is to be feared our pen may not have conveyed so complete a literary daguerreotype as might fain be wished—as regards means of gaining admission, we may furnish the principal regulations bearing thereon:—

"Tickets of admission to view the Mint will only be given to persons known to the Master, or to one of the principal officers of the Mint."

This regulation, it may be observed, receives a very liberal interpretation at the hands of the *present* Master of the Mint. "Persons coming with a ticket to view the Mint are to be received at the principal entrance by the visitor's messenger, who is to require the names of each party—which must not exceed six persons—to be written on the back of the ticket, and then to conduct them in succession round the following places, taking care that the whole time devoted to one party does not exceed 45 minutes:—The silver melting-house, the gold melting-house, the rolling-room, the adjusting-room, the cutting press-room, the marking-room, the annealing-room, the weighing-machine-room, the coining press-room, the die-multiplying press-room, and the die-turning shop." A pretty considerable "round" for three-quarters of an hour with "running" explanations by the messenger. The visitor's messenger enjoins those under his care "not to touch anything" in the rooms, and he in his turn is cautioned by regulation not to touch any gratuity from any visitor, nor allow any other person to do so.

Such are the main features of the regulations made for the admission of strangers to the Mint, and with them we say to those who have kindly followed us to the end—farewell!

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THE AMERICAN SUBMARINE WAR VESSEL.

SOME months since, the *Times* startled many persons by an exciting account of a submarine war-vessel. Mr. W. Delaney, of Chicago, the gentleman who came here to work the plan, has obtained a patent for the vessel, which he describes in his specification in the following terms:—

"This invention has for its object improvements in submarine boats or vessels, and in apparatus for working under water. A boat or vessel is constructed of plate iron, or it may be of wood or other material, supported by a frame of sufficient strength. This boat or vessel is closed on all sides; it is elliptical, or rather egg-shaped in transverse section, and runs off to a point at both ends; one end being, however, more rounded than the other, and its length is several times its greatest diameter; and at the top, bottom, and sides four or other number of keels are fixed to keep the vessel steady in the water. Within the boat or vessel are two strong metal tanks, into one of which air can be forced by an air-pump. This tank is connected with the second tank by a pipe furnished with a cock, and the second tank also communicates by a pipe with the water exterior of the boat or vessel; so that a person within the boat or vessel can fill this tank with water, and thus increase the weight of the boat or vessel so as to cause it to sink, or by allowing the air to pass from the air-tank to the water-tank, the water may be again ejected, so as to lighten the vessel sufficiently to cause it to rise to the surface. Through one end of the vessel a hollow shaft passes by a ball and socket-joint, and on this shaft a rudder is mounted. Beyond the rudder there is a screw propeller, which is driven from the interior by an axis passing through the hollow shaft of the rudder. By this propeller the vessel may be propelled in any desired direction. A similar screw may be placed at the other end of the vessel if thought desirable. The persons within the boat or vessel are supplied with air from time to time from the air-tank, and the vitiated air is allowed to escape from a cock into the exterior water. Double doors are formed in the top, bottom, and sides of the vessel, and these may be opened beneath the water to allow of ballast being passed out when necessary, and for other purposes. In conjunction with this boat or vessel a diving armour is employed, so that when the boat or vessel arrives at a point where work is to be done a diver may leave the same to do whatever may be required. This armour is formed of metal, the moving parts being so fitted and jointed together that the pressure of the water may be sustained by the armour and not communicated to the body of the diver. Through the sides of the armour a number of tongs pass, with which the diver can hold any tool with which he has to work, or any other article. These tongs pass through ball and socket joints, and are arranged to be readily acted on from the interior of the armour, so as to cause them to open and close. Into the ball and socket joints any tools may be fitted, and these also serve to pass short tools from the exterior to the interior of the armour as may be required. In order to facilitate the movement of the diver a screw propeller is attached to the front of the armour. The diver is supplied with air from the air-tank within the boat or vessel, or otherwise, and he also carries on his back a reservoir of compressed air, which enables him temporarily to disconnect the hose if required. The rope by which the diver is lowered is also so arranged that the diver can disconnect it if he desires. Exterior of the armour is an elastic bag, into which the diver admits air, so as to inflate it when he wishes to use the surface. A lamp is mounted within the armour, and in front of the same is a bull's eye, which concentrates the light on objects in front of the diver. The submarine boat or vessel is in some cases fitted with steam-engines, to propel it more rapidly when the boat or vessel is at the surface of the water. The same power also serves to pump air into the tank."

THE PATENT TRAVERSING DRILLING MACHINERY OF MESSRS. SHARP, STEWART, AND CO.

THOSE who are acquainted with the process of slotting holes through a considerable thickness of wrought-iron are well aware of the amount of trouble and time which is expended upon it under the old system of operation. There is, perhaps, no work so expensive to the mechanical engineer as this, and when complete it is but rarely satisfactory. We have now the pleasure of laying before our readers a description, with engravings, of a machine invented and manufactured by Messrs. Sharp, Stewart, and Co., of Manchester, adapted to the performance of the work in question. It does its work with such success that the cost of labour has been reduced some 90 per cent., and at the same time almost mathematical certainty has been secured. As an instance: a slot-hole 6 inches long, ¾ wide, and 5¾ inches deep, formed in the ordinary manner, would be produced in 32 hours at a cost of £1 2s. 2d., three files being expended upon the work. This can now be effected by means of the traversing drilling machine in less than 14 hours, at a cost of only 2 shillings, in the case of one workman having three such drills to attend to. With this fact before us it will be needless for us to expatiate further upon the advantages of such a system. We proceed therefore, to describe and illustrate the machine itself, and shall then enumerate the various purposes to which, up to the present time, it has been applied.

FIG 1

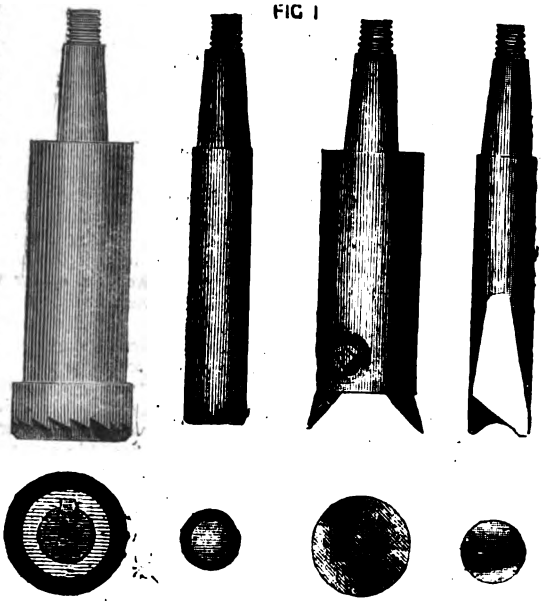


FIG 3

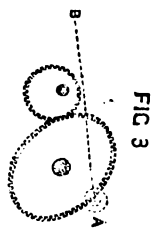
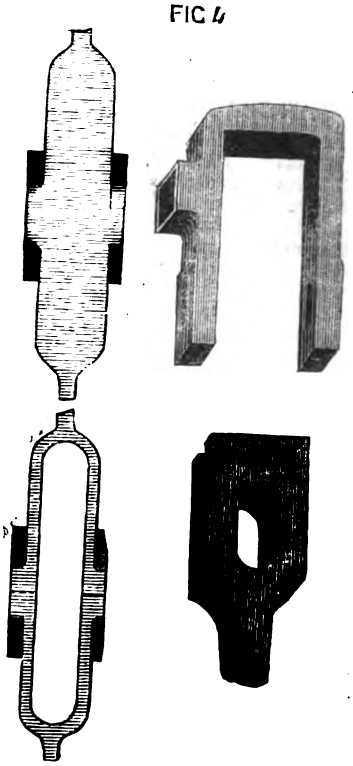


FIG 4



The general action of the ordinary drilling machine is well understood. The constant revolution of two paring edges round a common centre is employed in such machines to produce a vertical hole. If, then, instead of giving the tool a simple vertical feed, we endue it with a reciprocating motion, altering the form of its end so as to produce a double rounded nose with cutting edges, and taking away the centre clearing point, which is not now required, we are enabled to form a long slotted hole instead of a circular one. The vertical feed in this case must of course be given at each end of the traverse, so as to insure the plane of the cut being horizontal from end to end. Fig. 1 shows the various forms of the tools made for use in this machine. The first two are roughing tools, for small or large diameters. It will be noticed that in the large size the tools are adjustable and secured by means of set screws at their lower ends. The third and fourth tools shown are rose bits whose serrated edges are curved; these are used for finishing the work. Plans also of all the tools are shown below the elevations. The roughing-out tools on the average require sharpening but once in the week, and the rose bits but once in six weeks. Having investigated the form of the tools in use, we pass on to the consideration of the machine itself, and its mode of action.

In fig. 2 we have given a perspective view of one of the single traversing drilling machines; it consists of a strong frame of cast-iron after the fashion of a lathe bed supported upon a standard at each end. The top surface of this bed is planed true, and fitted with a hollow or box standard carrying the drilling spindle, which is worked in the ordinary manner by bevel wheels; this standard is caused to travel backwards and forwards upon the bed by the circular motion of a horizontal plate, which is slotted and graduated so that its projecting bearing can be shifted, and the reciprocation varied at pleasure. The spindle of the horizontal plate is driven by the lower shaft, which is figured *A*, by means of speed pulleys from the upper or first driving shaft *B*. Of course a regular velocity in the traverse cannot be attained by a simple crank motion, as the speed will gradually diminish to nothing at the extremities of the traverse; but this is obviated in a very ingenious manner by the introduction of a pair of eccentric-toothed wheels such as are shown in fig. 3. These are so arranged that the proportion of their working diameters varies so as to overcome the difficulty which would otherwise arise. The position of the connecting rod is shown by the letters *A*, *B*, in Fig. 3. Underneath the horizontal plate, which is

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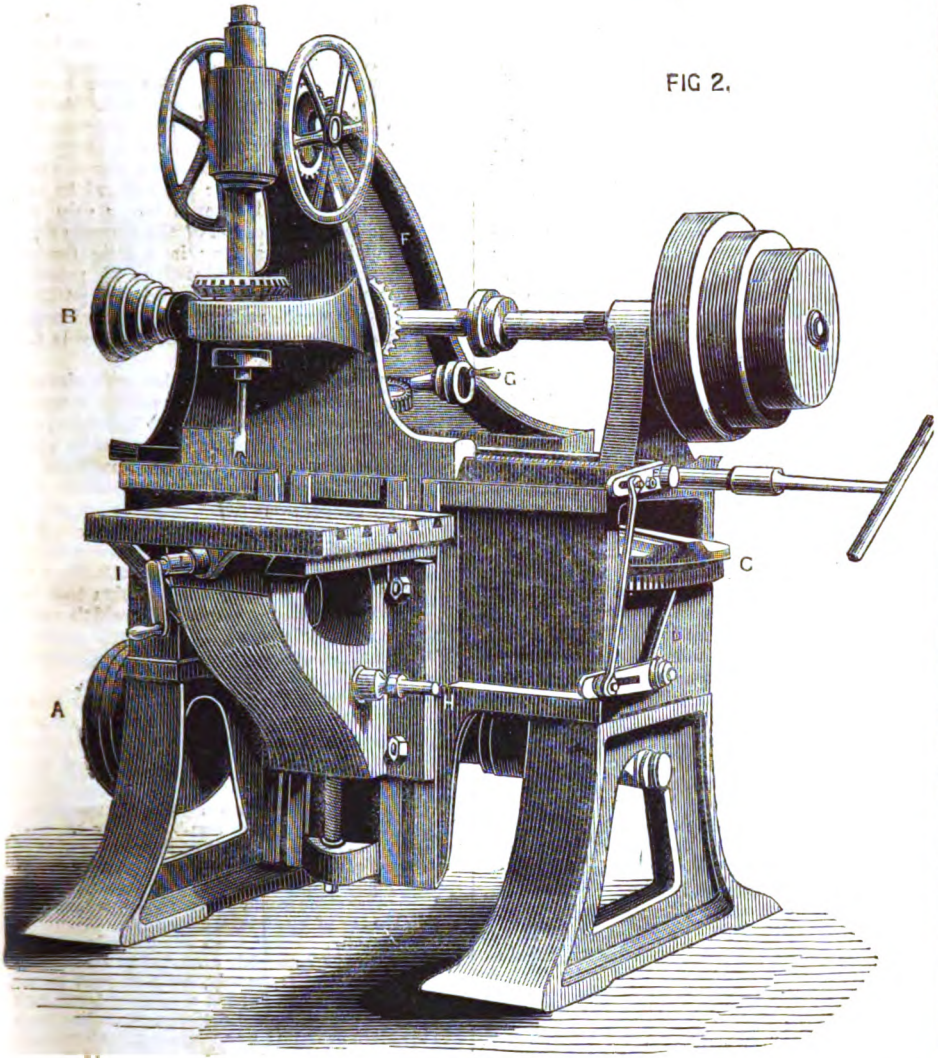

FIG 2.

lettered *C*, Fig. 2, is a roller-path, with a cam rising in two places. Rolling upon this is a wheel at the end of the crank lever *D*, which, by means of a short connecting rod, imparts motion to the lever *E*, which is fitted with a pawl playing upon a small ratchet, which is fixed upon a shaft, and thence by the inclined spindle *F* to the upper wheel, which, working in a rack, feeds down the drill; by this means the cut is given at both ends of the traverse. The handle *G* is used for working the inclined spindle, when required, by hand. In front of the bed or frame is fixed an adjustable table, similar to those used in the ordinary shaping machines, with adjusting screws for elevating or moving it horizontally so as to bring the work into its proper position. The spindles for this purpose are shown by the letters *H* and *I*. The upper chamber of the standard supporting the drill spindle is used as a receptacle for oil to be fed down to the cutting edge as required. These machines are often made longer in the bed and fitted with double standards, so that the operation can be carried on at both ends of a piece of work at one time.

Fig. 4 shows examples of two applications of this new system of work. The first is the stump end of a connecting rod and the strap showing the slot holes as also the transverse opening, all of which can be formed in this manner. Next to this is shown a pair of forked ends forged together in the solid, and these, when slotted out by the traverse motion, present the appearance which is shown by the letter *A*; they have after this to be merely divided, and the holes being drilled through, to be rounded in the shaping machine. The formation of keyways in crank and other shafts, and oil channels in brasses, &c., are amongst the many applications of the traverse drill. When the traverse is not needed the machine can be used as an ordinary vertical drill, so that it is an exceedingly useful tool in the engine and machine shop, and will, we doubt not, ere long entirely do away with hand labour for the purposes for which it is adapted.

THE MANUFACTURE OF CANNON.

By Captain Blakely, R.A., M.R.I.A., F.R.G.S., &c.*

My first experiment was to shrink a heated wrought-iron ring over one of cast iron. The result was the compression of the latter to an extent I by no means expected, the wrought iron being only slightly expanded. When separated, both tubes regained their original size.

I next made an 18-pounder gun, formed of a tube of cast iron, 5¼ inches in diameter, and 1¾ inch thick, over which were shrunk, side by side, short cylinders of wrought iron, the thickest of which was 2 inches. To resist the force of the gunpowder, therefore, this gun had a total thickness where strongest of only 3¾ inches; that of a service cast-iron 18-pounder being upwards of 5½ inches. Yet the lesser thickness was quite sufficient, even though the initial strain, calculated as necessary on the outer tubes, had been but very roughly approximated. As a cast-iron tube, 1¾ inch thick, was insufficient to resist the longitudinal strain, and as the wrought-iron cylinders were not joined, but merely placed side by side, four rods were used to give additional strength lengthways. These were fastened at one end to a ring carrying the trunnions, and at the other to an iron plate, which they pressed against the breech end of the gun. Two of these rods and the trunnions are not shown in the longitudinal sections, but are seen in the cross-sections. This gun was much stronger than necessary at the front part; indeed everywhere, except just round the seat of the charge. I regret, now, that I only fired it enough to prove that it was an efficient 18-pounder gun; had I continued till it burst, its strength relatively to service-guns would have been more definitely known. Being desirous, however, before injuring it to find out if a still thinner cast-iron core would suffice, I had this 18-pounder bored out to the size of a 24-pounder. Unluckily, in so doing the bore was not made in the centre, only half-an-inch of cast iron being left at one side of it. Even in this state, however, it bore, without injury, several hours' firing with charges varying from one shot and four pounds of powder, to one shot, two wads, and eight pounds of powder. It burst at the third round with the latter charge. This great strength was unexpected, the thickness of metal round the charge being only 2½ inches; whereas, in a service 24-pounder it is upwards of 6 inches. My gun, too, had much less windage. It weighed 15 cwt., less by 5 cwt. than the reamed-out 24-pounders which are used with a service-charge of 2 lbs. 8 ozs. of powder. The iron service 24-pounder for an eight-pound charge weighs 48 cwt.

The next experiment I made was to get a 9-pounder service-gun turned down cylindrical from the trunnions to the breech, and on this part to place wrought-iron tubes nearly the exact size and weight of the portion of metal removed, but just the necessary fraction of an inch smaller. The wrought-iron tubes had dove-tailed flanges, so that the one clasping the other gave some longitudinal strength; not that I think this was necessary. Indeed, if outer tubes had been placed merely half-way to the trunnions, strength enough would have been attained. This gun was fired as follows:—

2	rounds	with	8 lbs.	of	powder	and 2 shot.
86	„		3	„	„	1 „
26	„		4	„	„	1 „
5	„		5	„	„	1 „
5	„		5	„	„	2 „
318	„		6	„	„	2 „
1	„		6	„	„	3 „
1	„		6	„	„	4 „
1	„		6	„	„	5 „
1	„		6	„	„	6 „
1	„		6	„	„	7 „
1	„		6	„	„	8 „
1	„		6	„	„	9 „
158	„		6	„	„	10 „

A cast-iron service-gun, of about the same size and weight, was fired, round for round, with this gun until the 110th round, with six pounds of powder and two shot, when the cast-iron gun burst. The superiority of mine was so evident, that Her Majesty's Government had a 68-pounder and a 10-inch gun made almost on the model of it. The 68-pounder made in 1857 will, I hope, be tested this year or next.

My fourth gun was an 18-pounder. The inner cast-iron tube was only 1 inch thick, and open at both ends, the breech being closed by a plug. This was decidedly a mistake, throwing too great a strain on the four longitudinal bolts with which this gun, like my first, was provided, though these are not shown in the figure. Over the cast-iron tube I put two layers of wrought-iron tubes; the first broad, thin tubes (five-eights of an inch thick), the outer ones thicker and shorter. By making the two layers break joint, additional stiffness was obtained. This gun was fired—

1	round	with 6 lbs.	of	powder, 1 wad and 1 shot	
1	„	9	„	„	„
1	„	10½	„	„	„
1	„	12	„	„	„

At this round the four bolts gave way, although each was two five-eights inches thick—the four united being equal to a solid bar the size of the

* From a paper read at the United Service Institution.

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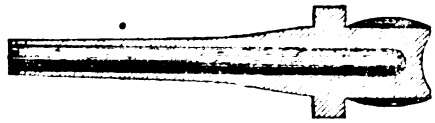
bore of the gun. The rest of the gun was uninjured, so that this trial was a great success so far as the method of obtaining lateral strength was concerned, the sides being at the thickest part only three five-eights inches thick. The charge which broke this gun was twelve pounds of powder—double the service-charge for guns more than double the weight, and four times the service charge of the 21-cwt. service gun. I had this gun remade with four bolts of the best charcoal iron; but they, too, broke, without injury to the tubular part. Though so far most satisfactory, this result made me decide not again to leave the entire longitudinal strain to be borne by outer bars

My fifth gun, which I made in 1856—those I have mentioned having been made in 1855—was a 12-pounder. The longitudinal strain I divided between four bars, attached as in former guns, and the cast-iron central tube which took half this strain, its breech-end, to insure this, having an aperture only half the size of the bore. This gun had two layers of wrought iron cylinders. The manufacture of this gun showed me the great uncertainty of the result of shrinking heated iron tubes. Those for this gun had been made of the same iron, carefully bored to the same diameter, and heated equally; yet about two feet in front of the breech they had compressed the cast-iron core so much more than in other parts, that the bore was there $\frac{1}{10}$th of an inch less. This determined me in future always to force the outer tubes on cold, making the outside of the inner tube a little conical tapering towards the breech-end. Great accuracy can thus be obtained. Indeed, the method of heating and shrinking on the tubes I had only adopted as a cheaper makeshift for the first few experimental guns. Knowing from former experiments that it would be useless to attempt to burst this gun with ordinary charges, it being much stronger than any former ones, I had long iron cylinders cast and turned accurately to fit the bore. Unfortunately, I had too great confidence in it; and, instead of waiting a day or two and having the compressed part again bored out cylindrical, I fired these closely-fitting cylinders from it. Having put in the powder for the fourth or fifth round, the cylinder was introduced, but stuck in the narrow part, and we could not get it out again. Thinking that the gun was too strong to be burst by gunpowder in any way, I fired it. It burst. Nothing could have been more injudicious than firing the gun so loaded. Not having any means of calculating the strain on it, nothing would have been proved had it remained sound. I should have been particularly careful, too, of this fifth gun, because I could not afford to make a sixth. This fifth gun proved nothing; but in all the others the increase of lateral, or rather circumferential, strength by my method of manufacture was great—indeed greater than I expected.

These guns had been made to test a principle, not as models. They would all have been too light for service except the 9-pounder. In No. VII. (Vol. II.) of the *Journal* of United Service Institution, page 323, I have given drawings representing the proportions and the method of manufacture I would recommend for large guns—to throw a ton of iron, for instance.



I will here give a drawing of an 18-pounder field and siege gun I should like to see supersede the 38-cwt. gun now used. This gun would have double the strength, would cost less originally, and, weighing only 22 cwt., the transport would require fewer horses. Only the breech-end would require the strength of the double tube; but for some purposes it would be well to have a few guns made as light as possible. In these the principle should be applied the whole length of the gun. By using wire the weight of an 18-pounder gun could with safety be reduced from 38 cwt. to 8 cwt.

Shortly after I had taken my patent for cannon (February 1855), Mr. James Longridge took one for making hydraulic presses on the same principle. To test it he had some small brass cylinders cast, one inch in diameter and one-tenth of an inch thick. Round these he coiled steel wire with a tension calculated to make each share in the work. When filled the cylinders could each contain 300 grains of the strongest sporting gunpowder. He put a certain portion of gunpowder into these, then at each end placed a copper globe, ground to fill up the aperture accurately, with the exception of a small touch-hole. The whole was then bound together by a strong wrought-iron strap, the section of which was about $2\frac{1}{4} \times 1\frac{1}{2}$ inches, and the balls keyed tight up to their seats by a jib and cottar. The powder was then exploded with results, from which he found that the same cylinder which, unsupported was bulged by 50 grains of powder, and burst by 90 grains, could bear the explosion of 200 grains when reinforced by four coils of wire, each only one thirty-third of an inch thick. The initial strain on each coil being so adjusted that each was equally strained with the greater charge. For this purpose the first coil was put on with a slight strain, the next with a greater, the third with a greater still, and so on.

Mr. Longridge next experimented with cast-iron cylinders, one inch in diameter and one-tenth inch thick, but close at one end. The other he secured much in the same way as in the brass cylinders. When filled these cylinders could hold 305 grains of powder. They were strengthened with iron-wire coiled on with the requisite increasing tension. With eight coils of No. 21 iron wire, then, it appeared that these cylinders could bear the explosion of 95 per cent. of as much gunpowder as could be put into them. To find if it was the material which gave this strength, and not the method of making each part do its work, Mr. Longridge obtained a piece of the best wrought-iron, and made a cylinder similar to the others in size of bore, but with sides *twenty times as thick*. This burst with a charge of 100 grains of powder. Mr. Longridge next made a three-pounder gun of a copper tube, with iron wire coiled on it. It was meant to be fired with its breech abutting against some resisting substance; but at Woolwich they fixed it with the front flange resting against a piece of timber, and, of course, blew the breech off. To test the strength of this cylinder Mr. Longridge afterwards loaded it, buried it in the earth between two strong pickets firmly driven in, and fired the charge. It showed enormous strength.

(To be continued.)

THE MAGNETISM OF SHIPS.

By F. J. EVANS, Esq., Master R.N., F.R.A.S., Superintendent of the Compass Department, Admiralty.

(Concluded from p. 41.)

In the Royal Navy, as recommended by a scientific committee of truly eminent men some years since, the system of no compensation is adopted as a general principle: but a rigid adherence to prescribed rules for preserving the compass as free from error as circumstances will permit is enforced—thus no iron is permitted within fourteen feet of it, if practicable; and a careful selection of site for each compass in every ship is made under proper supervision. It is accordingly found to result that the amount of deviation in the Royal Navy is in general small comparatively, and that no example of a deviation larger in amount, even in our iron ships, (in England) than from 25° to 28° exist, and this only in one or two exceptional cases.

The mercantile marine adopts more generally the system of adjustment, and this has led to the introduction of various patented compensating plans, differing widely from the Astronomer Royal's views, based often on no theory whatever, ending frequently in failure, and thus weakening the confidence of the seaman in the compass, and leading him to consider that the magnetism of an iron ship is so capricious as to be beyond all laws and all remedy.

These remarks may not be inappropriately closed by referring to examples of the remarkable want of caution on the part of iron-ship constructors and those engaged in their equipment, evinced in the injudicious arrangements for the compasses given in the Liverpool Compass Committee's Reports. Among the instances quoted will be found the following: "The error in the first position of the binnacle was 10°. As the ship was going to the East Indies, the compass-adjuster objected to compensate so large an amount, and the binnacle was then placed three feet forward; here the error was reduced to two points. In another and much larger ship the compass in the first position of the binnacle deviated 14 points; on moving it a little further forward, the error was reduced to $2\frac{1}{4}$ points." These cases occurred when the original position was selected near the rudder-head of iron vessels, in which a strong attraction existed towards the stern.

It must be evident that under such circumstances of position no compass, whether compensated or otherwise, can possibly act faithfully, nor can any accurate theoretical deductions be made from such examples; nor, above all, need we be surprised at the serious consequences which too frequently result from dependence being placed on these marvellous mal-arrangements. The Liverpool Compass Committee acted wisely in the promulgation of a circular calling attention to these facts, and expressing their opinion that by attention to the circumstances under which a ship is built, and care in selecting a suitable position for the binnacle, the original error of the compass may be reduced within small limits.

Any observations on the theory of a ship's magnetism would be incomplete without reference to Mr. Airy's method of compensating forces, based as it is entirely on the laws which have been referred to, that is,—

At any place the deviation of the compass in any ship, whether wood-built or iron-built, may be accurately represented as the effect of the combination of two forces, of which one alone would produce a disturbance following the law of polar-magnet deviation, and the other alone would produce a disturbance following the law of quadrantal deviation.

Consequently, at any place the deviation of the compass may be accurately corrected by well-known mechanical methods; namely, by a magnet in the athwartship direction, fixed at a distance determined by trial, for correcting the deviation when the ship's head is north or south; by a magnet in the head-and-stern direction, also at a distance determined by trial, for correcting the deviation when the ship's head is east or west; and by a mass of unmagnetised iron, at the same level as the compass, in the athwartship line or in the head-and-stern line, according to circumstances (usually in the former), also at a distance determined by trial, for correcting the deviation when the ship's head is N.E., S.E., S.W., or N.W.

For the same ship, the mass of unmagnetised iron, if adjusted at one port, will produce its due effect at all parts of the world, without ever requiring change or adjustment. The quadrantal deviation may thus be accurately corrected without difficulty, leaving only the polar-magnet deviation uncorrected.*

Mr. Airy's later investigations have led him to consider it desirable that the magnets should be mounted in such a manner that their distance from the compass can be delicately changed, to meet the changes of polar-magnet deviation.

We may expect at no distant period that there will be an accumulation of facts from various parts, particularly from the southern hemisphere, sufficient to prove the accuracy of Mr. Airy's views of compensation under all conditions, and whether its delicate and important manipulations can be entrusted to all classes of navigators. On one point, however, mariners may be assured, that at present no other method of compensation has been brought to their notice that has been more elaborately worked out by high scientific and philosophical attainments, or that could equally stand the test of such profound mathematical analysis, as has been brought to bear on the subject by the Astronomer Royal.

* See *Philosophical Transactions* for 1855, Art. V., Discussion of the Observed Deviations of the Compass in several Ships, wood-built and iron-built, &c., with a General Table for facilitating the Examination of Compass Deviations, by G. B. Airy, Esq., Astronomer Royal.

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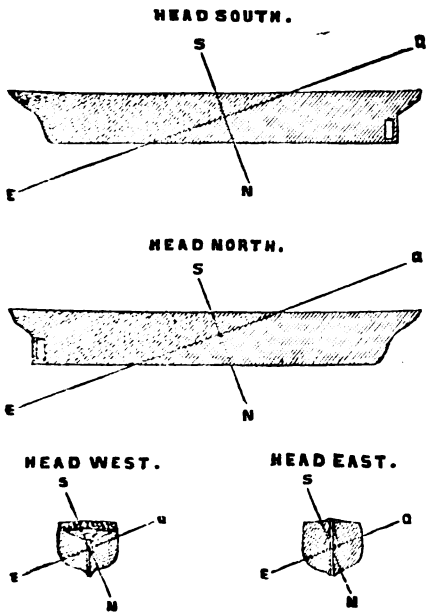
THE MAGNETISM OF SHIPS.*

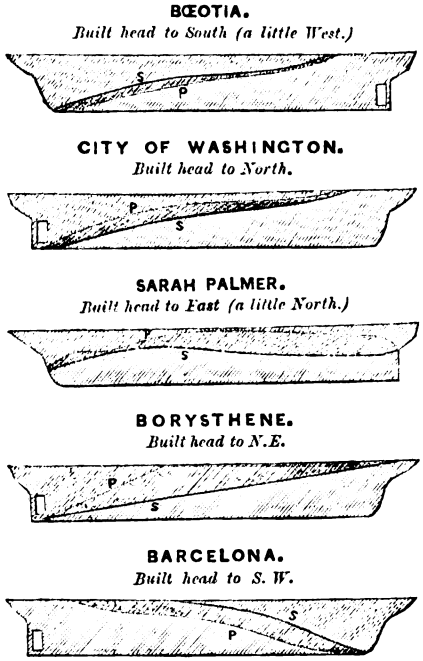
THEORETIC MAGNETIC CONDITION OF IRON SHIPS BUILT IN ENGLAND, WITH THE DIP OF THE NEEDLE FROM 68° TO 70° N., PREVIOUS TO BEING LAUNCHED, ACCORDING TO THE LATE DR. SCORESBY.



The axial line *S N* in each figure represents the direction of the dip or line of magnetic force as passing through the general centre of gravity of the material of the ship.

All below the equatorial line *E Q* shaded with firm lines has Northern polarity; all above it, shaded with dotted lines, has Southern polarity.

MAGNETIC CONDITION OF VARIOUS IRON SHIPS RESULTING FROM ACTUAL EXPERIMENT, AS DETERMINED AT LIVERPOOL BY THE COMPASS COMMITTEE, 1856-7.



NOTE.—The letters *P* and *S* denote the port and starboard lines of no deviation.

TASK-WORK v. DAY-WORK IN THE DOCKYARDS.

A FEW years since the system of day-work was ignored, and the public press was rampant in its censure, demanding task-work in order to satisfy the country that a fair day's work was obtained for a fair day's money. Task-work was therefore introduced, and in the course of a short space of time the most magnificent fleet that ever swam was fitted out from the Royal Dockyards; and where is the individual whose heart did not throb with delight on witnessing the departure of that fleet from Spithead in the late war with Russia? These ships were the strongest that ever floated; were built with the strictest regard to strength and economy; and the workmen employed were paid from schemes of prices requiring very nearly "double" the amount of the work done for money in the private dockyards, resulting in the fact that whilst by these prices the men of the dockyard got at the rate of 5s. 6d. per diem., those in the merchant yards, on the gun-boats and other vessels, were receiving from 9s. to 15s. Merchant builders were encouraging men of the dockyards to enter their service—making choice of them before others to work for them.

Finding job-work to the advantage of the employer, shipbuilders would have introduced it in the merchant service, but the men of the union inform us that they protested against it as oppressive in many cases, in consequence of the estimates and contracts being taken low, then underlet, and, consequently, the men ground down. Task and job-work now receive the censure of those disposed to find fault, and object to restriction, and there is a disposition for change, though it is found that whilst the people on task-work get 5s. 6d. per day as earnings, the work is done at one-third less expense than by employing the people on day-pay—at 4s. per day. Job work is nothing more than payment of so much for building the ship, whilst task-work provides for the various jobs distinct in building. To have vessels built substantially, let there be a greater number of foremen made who can watch the operation of the works, and then task-work is the best for the service. Let the Admiralty call a committee of the superintending measurers of the various dockyards together, and from our personal knowledge of them it will be found that an amount of invaluable information will be collected. It was the saying of an old master shipwright—"If you want your work done have task-work; if you don't want it done have day-work."

There is another very important matter to be considered. The master measurers of the various yards have an important trust committed to them. They are responsible for the proper discharge of the whole of the duties of the office—to see that the thousands of pounds weekly of the public money are properly expended, and the work done in a workmanlike manner; and yet their pay is but £180 per annum, whilst there are those appointed to do the secondary duty of dividing the money for payment who have salaries of between £300 and £400 a year, with others to assist at the same rate. If ever there was a mistake this is one, and we hesitate not to say, that with proper organization £20,000 per annum of the public money may be saved through the instrumentality of task-work. Give support to the master measurers, and pay them for their responsibility; and seeing that they have a very great responsibility to sustain, give them a first instead of a subordinate position. Now they can be snubbed and silenced in the face of injustice, and compelled to be dumb; give them their due importance, and justice will be secured in every respect to the country.

It may be added that if there is any doubt about the difference between men in the Dockyards and the private establishments, we know and affirm that the former are by far the best and most substantial workmen.

Mis-statements have been made in the House of Commons that will be confronted, and if His Grace the Duke of Somerset, with the noble lord the secretary to the Admiralty, but give a trial to the preceding suggestions, economy will be secured in the public establishments, and an opportunity given for those who have been calumniated to prove themselves up to the mark. PHŒNIX.

* See page 42 in last Number.

TRIALS OF MOWING AND REAPING MACHINES AT WARWICK.

THE mowing machines were tried upon a piece of grass belonging to Mr. B. Dickinson, Goy Brook Farm, not far from the town of Warwick. The crop was rather light. There were three mowers in the field—Burgess and Key's, Wood's (American), and Harwood's, which we alluded to in our account of the Ipswich Show. It was soon evident that Mr. Harwood had little chance of competing with either of the other two, for his machine left patches here and there uncut altogether; and when it did cut, the lowest sweep it was capable of making left much too good a portion of the grass upon the ground. Wood's did much better; but that also left occasional patches, and could not cut uniformly, and sufficiently low, so as to secure the greatest bulk and the sweetest portion of the crop. We entertain the same opinion as we have already expressed, as regards the grass-cutting powers of this machine. The mower of mowers, at least as far as we have yet seen, is that belonging to Messrs. Burgess and Key. There is no mistake about its effective working power; it goes into the crop, no matter how laid or trampled upon, and cuts it, to speak in familiar phrase, as close and as clean as a razor. This fact was evident to every spectator in the field, many of whom closely examined the ground, and most of whom, who had any practical knowledge of such matters, expressed themselves in the highest terms as regards the power of the machine. The saving in the crop of even moderate weight and extent, when cut by a mower like the one we have briefly alluded to, would therefore nearly pay for the first cost of the machine. As a proof, moreover, of the opinion entertained by the owner of the field as to the merits of the machine, he requested Mr. Burgess to cut the remaining portion of the crop, to which he acceded; and we have since seen a copy of a letter, addressed by Mr. Dickinson to Messrs. Burgess, in which he expresses his high satisfaction at the manner in which the work was done, and gives a practical proof of his convictions being well founded, by securing for himself one of these mowers.

The reaping was upon a piece of green oats, and did not furnish any very satisfactory results as to the relative power of the machines. The crop cut belonged to Mr. Woodwards, and though it was heavy and much laid in places (supposed to have been purposely trampled down to baulk one of the machines), the best reaper did its work very well. Messrs. Burgess and Key's well-known machine cut down some of it in the condition just described, about one acre and a quarter, and left the ground very clear of the green corn. The others did their work very fairly, considering all things, the nature of their construction, and the difficulty of handling so unfavourable a crop. However, it was a mere experiment, got up to amuse the visitors, more than to show the working power of the reapers. Not so as regards the mower. Everything connected with that machine was serious and earnest, as regards its work; and so well did the Society appreciate the mower, that a silver medal was awarded to it.—*Bell's Weekly Messenger.*

RIFLING LARGE CANNON.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN, — Captain Jervis, R.A., in his place in Parliament has asserted that it is impossible to rifle large cannon. I will undertake to have a sixty-eight pounder rifled, which shall throw an elongated iron or steel shot, poised on wooden wings to prevent injury to the interior of the gun, and of between two and three diameters of the bore of the gun in length, and undertake, also, to fire two such rifled cannons instantaneously by percussion, after the manner

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that I fire two of my percussion blasting cartridges placed in the same line, and two or three feet apart, when blasting the monster stumps of large forest trees.

I should like to know how plates of iron four and a half inches thick could stand the simultaneous blow of two such elongated steel shot.

Your obedient servant,

J. NORTON.

Rosherville, 16th July.

BOAT-LOWERING APPARATUS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—As the qualities and merits of mechanical contrivances can never be settled by argument, it would be useless for me again to repeat the answers I gave in my last letter to you in reply to the former objections urged against my system of lowering boats by "Nauticus," and of which his letter in your last week's impression is mainly a repetition. I then offered to show the groundlessness of such objections by at once submitting to any practical tests to disprove them, and this, too, against any other inventor or invention. Competitive trials of rival improvements under the very circumstances and cases for which they are required can be the only satisfactory solution of the efficiency of either to accomplish the desired ends, and settle their relative capabilities; and the results of such trials are the only substantial arguments on which judgment should be formed.

In order to meet theoretical objections by actual practice I devoted three years entirely to going to our different seaports and dockyards in order to prove in my own person that my invention was capable of effecting all it proposed to accomplish. Not only have I never had one accident during that time, but I now repeat that I am at any moment prepared to show how efficiently the system will work under those very positions in which "Nauticus" considers it would be useless. But more; repeated instances have occurred, as he or any one may see from my published pamphlet, of lives having been saved under just such circumstances as he describes.

With respect to pendants having broken in some of Her Majesty's ships, I myself admitted this had occurred, and I gave as the cause that rope of a character and quality different to my printed instructions had been supplied, but that this had happened with reference to the rope supplied from one yard only; but I never hinted at the invention having been neglected by the Dockyard authorities generally. Very far from it. I am fully sensible of the attention that has been paid to my instructions, the facilities that have been afforded me to carry them out, and the general excellence of the workmanship and material supplied at all the Government yards. I feel this acknowledgement the more due, because I never had a particle of patronage or official influence to help me along; and I believe that sympathy with the cause I advocated, viz., the observance of better precautions for the preservation of life at sea, had more to do with the readiness that has been shown to help me than anything else.

The "written statement" published by "Nauticus" in reference to the alleged loss of "the whole of a boat's crew" of Messrs. Greens' ship, the Orwell, and imputing such a catastrophe to my lowering gear, is simply an untruth; and it is to be regretted that a statement calculated to do such a serious injury, should have been anonymously published in your paper, and upon an anonymous authority. It will be quite sufficient to send to you a statement from Messrs. Green, written after a full inquiry into the circumstances on the return of the ship, and which I have also from the captain of the ship; I quote their very words—"that there was not the slightest blame attached to Clifford's lowering gear on that occasion;" and they add, moreover, "that where it has been fitted in Messrs. Greens' ships, it has given general satisfaction." I leave you, Mr. Editor, and the public, to draw your own conclusions of the value of theoretical objections substantiated by such evidence.

And now, Sir, as "Nauticus" has referred to the subject, I must make one remark about rival inventions. In endeavouring for several years to bring before the Government and the public the almost universal disregard of life at sea, shown in the neglect of the necessary precautions in the event of emergency, I have always contended that it is the duty of the Government to make it compulsory that all ships should have on board *an efficient means of lowering the boats*, but that such efficiency ought to be decided after actual test and experiment under properly constituted authorities, and not left either to the option of officers in charge or owners, who would too frequently let friendship or interest influence their decisions. If in exposing the evils of the system generally in use I have shown the palpable advantages of a better one, and adduced instances of my own invention having saved lives, it has simply been because in this respect it stands alone, no other having done the same; and however I may have endeavoured to show the criminal responsibility that rested with the Government and officers in charge in failing to have such at hand, I have scrupulously avoided attacking any other inventor, holding that all had a like right to a chance of public trial to prove their practical value.

Such anonymous letters as those of "Nauticus" and others show that the attention of naval officers is at last being aroused to the consideration of a subject they have allowed to pass unheeded too long.

When any one will accept the challenge I gave in my last letter, and prove by actual working the superiority of any other plan to mine, so much the more to the public good. Till they do so I shall not forego the claims mine has established to the position that has been accorded it by the patronage it has received from different departments of the Government; and I can refer with no little satisfaction to the leading mercantile firms of London and others who have long had it in practice, and many of whom have saved lives by its use, in confirmation of what I have advanced.

Yours, &c.,

CHARLES CLIFFORD.

14th July, 1859.

THE STEAM RAM.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I am much obliged by the insertion of my letter upon the steam ram, and for the notice you have taken of my communication, which affords me the opportunity of expressing an opinion I have long entertained—it is simply this:—

Small steam-vessels of the greatest practicable speed, and of a construction and form adapted to the service of, and armed with submarine explosive shells, would, in naval combat, prove more than a match for large ships or steam-vessels armed with any kind of cannon and projectiles at present known; and that the *larger* the ship or vessel so armed, the more easily could she be sunk or blown up by the *small* steam-vessel.

The employment of submarine explosive shells inverts, as it were, the whole system of naval tactics; for the smaller the vessel, so that she possesses speed, darker the night, more tempestuous the weather, the more easily would she accomplish her work of destruction. Not that such conditions must obtain if she be properly constructed and equipped; she would under any condition do her work in the light of day by submitting to a trifling sacrifice of damaged topsides.

I will avail myself of this opportunity to remark that the important problem of the submarine explosive shell has never been, by the proper authorities, examined; much less has it ever been, in a practicable form, solved. The sooner it is the better will it be for England—not only as it may spare her an immense outlay upon useless labour and skill, but as it may also affect her supremacy upon the ocean. I remain,

JOHN HARVEY, R.N.

Sandgate, Folkestone, July 16th, 1859.

Law Case.

COURT OF QUEEN'S BENCH, Guildhall, July 14.—(*Sittings at Nisi Prius, at Guildhall, before Lord Chief Justice Cockburn and a Special Jury.*)

GRIFFITHS *v.* TURNER.

Mr. Bovill and Mr. Hindmarch were counsel for the plaintiff; and Mr. M. Smith and Mr. Sumner for the defendant.

Mr. Edward Griffiths, of High-street, Camberwell, confectioner, brought this action against Mr. George Turner, of Dover-road, Borough, dealer in patented articles, for an infringement of plaintiff's patent apparatus for beating the whites of eggs and other fluids. The infringement was admitted, and the question was whether the patent was not void for want of novelty. The defendant relied on a patent of Messrs. Pollitt and Eastwood for churns, and a publication of an invention by Mr. Harkes, also a patentee for churns, being substantially identical with the patent of the plaintiff, and prior to it in point of time.

The trial, which commenced on the 13th, was not concluded until 4 o'clock on the 14th, when the jury found that as to Pollitt and Eastwood's patent it was the same as the plaintiff's, with this difference, that the plaintiff's had concentric axes, which, in the opinion of the jury, was an important improvement with reference to the object to which the apparatus was applied; and that as to Harke's invention it was the same in form and construction as the plaintiff's, with the difference of having flat expanded wooden beaters, whereas the plaintiff's had slight wire bars, which more readily effected the object of the apparatus.

The Lord Chief Justice said the plaintiff would have the right to raise the question whether, notwithstanding the similarity of the instruments, the novelty of the combination was not sufficient to constitute a good patent, and the defendant would have the right to raise the question whether, looking at the particular language of the specification, the points of identity found by the jury were not sufficient to invalidate the plaintiff's patent. It did not seem to him of much consequence how the verdict was entered.

Verdict for the plaintiff, with liberty to defendant to move.

Our Weekly Gossip.

A DISCUSSION was raised a few evenings since by the Earl of Airlie in the House of Lords on the arming of mail and other steamers for war purposes. In the course of the discussion the Duke of Somerset said that for many years it had been part of the contract with the companies which carried the West Indian and other mails that they should adapt their vessels to the purpose of carrying armaments. About the year 1852 a committee of military and naval officers inquired into the question, and reported that it was not expedient to attempt to fit these vessels for purposes of war; that, in fact, in doing so we diminished their utility for purposes of traffic, and only made them very inefficient for those of war. In the year 1853 there was a further inquiry by professional men, who reported that by means of a considerable expenditure some of these steam vessels might be rendered capable of carrying armaments, but that under those circumstances they would only be able to defend themselves, and could not contend with vessels of war. A suggestion had been made by Mr. Laird that some of the small steamers on the Mersey might be fitted out for the purposes of defence, and as soon as the question was brought under the attention of the Board of Admiralty they sent down an officer to survey the vessels, and report how far this scheme was practicable. He did not anticipate that very much would arise from this inquiry; but, at the same time, it was desirable that we should know how far these vessels were applicable to the purposes of war. Few persons were now of opinion that these large commercial steamers could be fitted for war, and any money expended for that purpose would be entirely thrown away; but, looking to the means of production at the command of these great companies, there was no doubt that if any sudden emergency did arise they might be made available for turning out vessels of war at short notice. The late Government had tried this to some extent by making arrangements to

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build a certain number of corvettes by contract, a species of vessel which the commercial yards were peculiarly qualified to deal with, and if any sudden emergency should arise he should be inclined to deal with the matter in the same spirit. The answer, therefore, to the noble earl's question was, that the Government had considered the expediency of entering into arrangements for the arming of these large commercial steamers, but they were not disposed to re-open a question which had already been decided in 1852 on grounds which might be seen on reference to the report of the committee. The Earl of Hardwicke agreed entirely in the decision arrived at by the noble duke. Unless Parliament chose to go to the trouble of providing for the manner in which those steamers should be built it was impossible to hope that they would ever be available for war purposes, and any money spent for that purpose would be thrown away. At the same time, there was no doubt that the producing power of the mercantile navy might be safely relied on for the rapid production of war vessels on an emergency.

In reference to the letter of Capt. Harvey, R.N., which appears in another column, we may state that he has, he believes, completely succeeded in producing an engine of destruction, in which are combined easy construction with cheapness, safety when charged and when stored, facility of application in combat, with perfect freedom from danger, while the shell would be horribly destructive to a foe against whom it might be employed. A submarine explosive shell, embracing such essentials, is deposited for public inspection in the Museum at Canterbury. In the summer of 1844 Capt. Warner made an experiment off Brighton, which suggested to Capt. Harvey the importance of submarine explosive engines in naval warfare, looking to the then altered state of navigation, as compared to what it was in the days of Nelson, by the application of steam-power to nautical purposes. Under this impression he set about constructing a shell to explode under water, such shell to be brought into contact with the object of attack by being towed by a steamer of superior speed, or by spanning two shells with a buoyant line of about 100 yards length, and when so spanned, to stretch them across the course of the advancing or pursuing enemy. To this matter Capt. Harvey endeavoured more than 14 years since to gain the attention of the Government, but in vain. But we have now a neighbour who will not be restrained by antiquated notions of chivalry, or rules of legitimate modes of warfare. He well knows that the art of war is the art of strategy; and should he and his legions at any time resolve upon an invasion of our stores, and should he be before hand with us in the employment of the arm to which Captain Harvey draws attention, he could, in less than 24 hours, clear the Channel of hostile vessels, so that his troops in their passage across would meet with no interruption. It is upon the engineering and mechanical skill of England that her safety depends; for the gentlemen in the profession of arms are but too often under the dominion of fixed ideas.

Mr. T. Moy writes on the subject of steam-ship performance as follows:—"As this subject is likely to be revived at the next meeting of the British Association, allow me through your pages to suggest the following formula for obtaining a co-efficient:

$$\frac{d \times v}{p} = c.$$

d = displacement in tons;
v = speed in feet per minute;
p = indicated horse power."

The new French gun, of the performance of which we hear so much from Milan and from the French camp, but not from the Austrian side, cannot be an arm of the same precision as the so-called Armstrong gun, because no attempt is made to lessen the windage of it, the shot fitting not more closely than the ordinary round shot. The interior of the barrel is rifled with three, four, five, or six flat, rectangular, shallow grooves—the heavy naval guns with three, the field-gun used in Italy with six, the other, indeed the whole thing, being yet only experimental. The shell, which is of iron, is about twice and a half as long as it is broad, the greater part being cylindrical, the rear end quite flat, and the point conical. The fuse enters this point. From this iron shell projects small leaden trunnions, double in number to the grooves of the barrel, so that into each groove fit two of the little projections. These look like round leaden coins laid on the shell in two rows. They, however, are firmly fixed, being cast into holes broader at the bottom than at the surface. But a small portion of the surfaces of such projections can bear on the barrel, so that the lead must strip, or at least lose its shape. The form is exactly that which admits of least bearing surface. In Lieutenant Engstrom's patented shells (1855) he uses round trunnions to fit into the grooves of his rifle, but then he had an object in so doing, viz., to enable him to use a decreasing twist. In the French shell all the disadvantages of the system are adopted without the advantage, for with a double row of trunnions of course the twist of the groove must be uniform.

It was a very pleasant change last Saturday, after the rumours of bloody deeds of war which have been exciting such painful interest during the last two months, to be present at the fête which was given by those interested in the proposed Palace of the People upon the site at Muswell-hill. This beautiful spot is situated to the west of the Great Northern Railway, about half-a-mile from the Wood-Green station, which is five miles from King's-cross. The total property about to be purchased by the proposed Company covers an area of 450 acres, about 150 of which are to be devoted to the purposes of the palace, and the rest will be made available to the shareholders for building and other purposes. The rise from the railway, through pleasant green fields, to the upper level on which the palace is to stand is 198 ft., and the view from the summit is extremely varied and extensive, in fact in one direction it is possible, on a clear day, to see a distance of fifty miles. Within a radius of six miles of this hill north of the Thames are situated 32 distinct towns and villages containing a million-and-a-half of inhabitants, and we understand that it is with the intention of providing a place of innocent recreation for this vast population that the Palace of the People is to be built. It was at first considered by some that such a place was not required, and that it would interfere with the ultimate success of the Crystal Palace, but it appears that such will not be the case; the erection of the Palace of the People may produce a spirit of emulation but not of competition: in fact, the presence at the fête of Mr. Bowley, the talented manager of the Crystal Palace, would sufficiently show that the interests of both will be promoted by this new undertaking. It is also an established fact that at present there is no place of public recreation of a similar nature on this side of the river. We understand that the building itself will be 1,080 ft. long by 312 ft. wide, and will be surmounted in the centre by a large dome of crystal 200 ft. span. This will be glazed as far down as the ground level so as not to intercept the view, and be used as a tropical garden. The building will also be provided with a concert-room capable of holding 10,000 people. We are led to understand from the estimates, that the total outlay will be about one-half of that invested in the Crystal Palace, so the success of the undertaking in a commercial point of view is pretty well ascertained. The summit of the hill, so soon to be a busy scene of labour, was on Saturday crowned with a large tent, under which was spread a substantial repast; the guests, to the number of 150, including many men of influence. After surveying the grounds and welcoming Lord Brougham, who it appears takes a great interest in the success of the undertaking, we had the pleasure of listening to a preliminary report, which was read by Mr. John Masterman, to which Lord Brougham replied in eloquent terms, stating that for many years he had been looked upon as the head of the educational movement, that he had often been charged with paying court to the people, but here, upon the site of the Palace of the People themselves, he would give them some good advice. He then said that all working men required relaxation, and that relaxation must be mental as well as physical; that the object which those interested in this Palace of the People had in view was the promotion of such relaxation; but to effect this three principles would be involved: it must be innocent, it must be conducted within the bounds of prudence, and it must be entirely free from a vicious tendency. He then gave a slight sketch of the manner in which this would be carried out in the Palace of the People, through the instrumentality of reading-classes, lectures, &c., and concluded by wishing every success to the undertaking.

The American aëronauts have just performed a feat worthy of being chronicled—an attempted trip from St. Louis to the city of New York. The New York letter of the *Times* gives the following account of it:—The balloon, one of monster size, was in addition provided with revolving wheels for propelling it any desired direction, and with a metallic lifeboat suspended to the car, for use in case of falling in the water. As it turned out the precaution was a wise one. They left St. Louis about 7 o'clock in the evening of the 1st in the presence of a crowd of many thousands. At 4 o'clock in the morning of the 2nd they passed near Fort Wayne, in Indiana, and at 9 of the same morning passed near Cleaveland, and over Lake Erie. In this part of their passage their speed is reported as nearly 75 miles an hour. Up to this point they seem to have followed the course which they had marked out for themselves. The plan was to have followed the course of the Central Railroad across the State of New York and thence down the Hudson River to New York; but unfortunately they determined first to make Rochester, near Lake Ontario, and land one of their passengers. In descending to do this they fell into a hurricane strata which drove them out to sea, and obliged them for safety to make way to shore and abandon the rest of their trip. In less than 20 hours, however, they travelled 1,150 miles, and they think that they have demonstrated that for which this was an experiment—the possibility of an aërial trip across the Atlantic.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c. *None.*
BOILERS AND THEIR FURNACES, 2774, 2803.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2775, 2779, 2796.
SHIPS AND BOATS, including their fittings. *None.*
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2784, 2789.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2771, 2802.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2777, 2782, 2783, 2785, 2786, 2791, 2792, 2800, 2801, 2805, 2808.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 2781, 2795.
LIGHTING, HEATING, AND VENTILATING, 2787, 2807.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2780, 2794, 2798, 2804.
METALS, including apparatus for their manufacture. *None.*
CHEMISTRY AND PHOTOGRAPHY. *None.*
ELECTRICAL APPARATUS, 2773.
WARFARE, 2778.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 2772, 2776, 2788, 2790, 2793, 2797, 2799, 2806, 2809.

2771. J. CAMERON. "Improvements in apparatus for the manufacture of sugar." Dated December 4, 1858.

This consists in constructing apparatus for curing or cleaning sugar by vacuum, with a false bottom or surface for supporting the sugar, constructed of a series of separate flat-topped bars arranged in close proximity over a chamber capable of being exhausted of air. *Patent completed.*

2772. R. LEGG. "A machine for combining the operation of compressing and cutting tobacco during the process of manufacture." Dated December 4, 1858.

This consists in a machine in which the tobacco leaf (after the damping process, when that is employed) is received into a feeding trough or box, from which it is drawn forward, and submitted to a yielding pressure by and between rollers which convey it to the mouth-piece, where it is then submitted to the action of the knife. The invention is not described apart from the drawings. *Patent completed.*

2773. L. W. FLETCHER. "Improvements in the construction of electric telegraph cables." Dated December 4, 1858.

This consists, 1, in certain modes of constructing electric telegraph cables whereby the conducting wires shall be prevented from being injuriously elongated by any elongation of the covering wires. 2. In coiling or twisting the conducting wire, or the strand of conducting wires in contrary directions, so that when the electric telegraph cable is in a state of tension the said wires may be free to elongate to a greater extent than the covering wires. 3. In weaving fibrous materials over the conducting wire previously to insulating it. 4. In weaving a tube over the insulated wire. This woven cover or tube may be made of wire-warp and a binding weft of hemp, &c., or *vice versâ*. 5. In covering the insulated core of electric telegraph cables with woven strips or bands of a combination of wire and fibrous material saturated or coated with india-rubber or other suitable substance. The invention is not described apart from the drawings. *Patent completed.*

2774. J. B. FISHER, J. FISHER, and J. BIRD. "An improvement in the doors and dampers of furnaces and other places where intense heat has to be resisted." Dated December 4, 1858.

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This consists in forming the doors and dampers of furnaces of a single slab of fire-clay, bound with wrought or cast-iron. *Patent completed.*

2775. R. PICKERING. "Improvements in communicating signals from one part of a railway train to another." Dated December 4, 1858.

Here a flexible tube is carried along beneath the bottoms of all the carriages in the train, terminating in a whistle at a part where the engine-driver stands. This tube is in separate lengths for each carriage, provision being made for coupling the ends when the train is made up. Each carriage has a branch tube with a mouth-piece for blowing into; and each branch tube has a sub-branch and a mouth-piece and tap or valve for each compartment. *Patent completed.*

2776. E. A. SERVIER. "Improvements in pressure and fluid level indicators." Dated December 4, 1858.

The peculiar characteristic of this apparatus is the giving of a different signal for each extreme limit, and of a third signal for the intermediate degrees of pressure or points of elevation. The invention is based upon the following principle:—Where an electric current passes along a wire in the immediate neighbourhood of a magnetic needle, the latter will be deflected from its normal position in one direction or the other, according to the direction of the electric current. The patentee has applied this principle to existing pressure and level indicators. *Patent completed.*

2777. T. SIDLEY. "Improvements in looms for weaving." Dated December 4, 1858.

This relates to those looms in which tappets are employed for working the treadles that operate the warp threads, and refers to those tappets known as "Woodcroft's patent segment tappets," more particularly single-acting tappets. The object of the invention is to facilitate the changing of such tappets. The patentee claims, 1, securing the tappet-holding plates of tappet cylinders together by bolts, so that they will not have to be disturbed when placing, removing, or re-arranging the tappets. 2. Retaining the tappets in their places by loose pins which are prevented from moving endway. *Patent completed.*

2778. A. SMITH, J. TOWNSEND, and E. W. WILLIAMS. "An improvement or improvements in breech-loading fire-arms." Dated December 4, 1858.

This relates to those breech-loading arms in which the barrel moves in a vertical plane, and consists in means for securing the barrel in its place during discharge. The inventors make a double incline or two inclines turning on axis in the body of the fire-arm, the said inclines being situated opposite to each other on the axis. On the under side of the barrel two knuckles or staples are formed with which the two inclines engage. The fastening is effected as in the ordinary construction by the motion of a handle on the axis of the inclines. They prefer to make the inclines and the handle in one solid piece. In the body of the gun two openings are formed through which the knuckles or staples on the under side of the barrel pass to engage with the inclines. The said openings are made out of the solid, and the axis on which the inclines turn is fixed on the underside of the solid bar separating the two openings. *Patent abandoned.*

2779. J. B. A. MONNIER. "Improvements in actuating railway brakes." Dated December 4, 1858.

This consists in so arranging the apparatus for applying the brakes that the rotation of the wheels shall, when required, put on the brakes, and also so that the rotation of the wheels shall, if there is more than one brake carriage in the train, transmit the motion to all the brakes. *Patent completed.*

2780. J. TURNER. "Improvements in the construction of chairs." Dated December 4, 1858.

The inventor constructs a chair in two parts, the seat and front legs forming one part, and the back and hind legs the other part. To hold the two parts together, a screw nut is let into each of the side rails of the seat, and other screw nuts at the lower part of the back where the seat is to be fixed to it. These screw nuts are drawn together by screw bolts. In some cases he connects the two parts of a chair by fixing metal studs or buttons on one part to outer holes in metal plates fixed in the other part. *Patent abandoned.*

2781. H. T. YATES. "Improvements in the manufacture of boards or sheets, when wood sawdust is used." Dated December 4, 1858.

Here the wood sawdust is sifted into several degrees of fineness; the finer qualities are used for making the thinner sheets or boards. A quantity of powdered resin (generally about one-eighth of the weight thereof) is intimately mixed with the sawdust. In some cases particularly, for the coarser articles, pitch is employed instead of resin. A heated metal plate is used on which a sheet of paper or woven fabric is placed, then a frame or mould according to the size and thickness of the intended sheet or board is placed on the paper. This mould is filled with the composition, then, when the mould has been lifted off, another sheet of paper or woven fabric is placed on the composition, then a hot metal plate, and so on with numerous layers one over the other, and the pile is placed within a powerful press and subjected to pressure until set. Modifications are included. *Patent completed.*

2782. J. L. NORTON. "Improvements in machines for stretching and drying fabrics, and in drying wool and other fibres." Dated December 4, 1858.

This relates to such machines as are constructed with two endless chains furnished with points to receive the selvage of the fabric, and in which such chains having received the fabric separate so as to stretch it to the desired extent, and afterwards carry it through a drying chamber. The chains are formed by stamping from wrought-iron. The chain consists of long and short links, arranged thus: two long links are placed side by side, and short ones between them; at their ends these links are held together by pins passing through the extremities of both the longer and shorter links; thus a chain is built up composed of long and short links alternately. The points to receive the selvages are held together by casting metal on to them, and the cast block so obtained has a stem which passes through holes in the long links and is secured by pins, &c. The chains traverse in guides similar to those employed heretofore. To heat the drying chamber the inventor employs a series of closed metal cylinders, to which steam is admitted. Through these cylinders a number of tubes pass, the arrangement being similar to a tubular steam-boiler. Air enters the drying chamber, or through those tubes, and thus becomes heated. From the lower part of the drying chamber a flue conducts away the air, which has been moistened and partially cooled by contact with the fabric. For drying wool and other fibres an endless fabric is placed on the chain and the fibre spread at one end of the machine uniformly on the endless fabric as it travels, and the dried fibre is discharged at the other end. *Patent abandoned.*

2783. M. HENRY. "Improvements in weaving and in looms or apparatus employed therein." (A communication.) Dated December 4, 1858.

This relates to a mode of weaving shawls, ribbons, and other fabrics, by means of which coloured threads will be interwoven only at the precise spot at which they are desired to appear. It consists in the method of action of a number of weft bobbin carriers, or hooks, rods, or pins, fitted to the loom or apparatus, and carrying weft bobbins or pins, and which effect in respect of the weft what the jacquard effects in respect to the warp, so as to produce a weft pattern in parts, and so that a very large number of small coloured wefts may be kept in the same line and in the same direction. *Patent completed.*

2784. W. E. NEWTON. "Certain improvements in grain and grass harvesting machines. (A communication.) Dated December 4, 1858.

This relates, 1, to those machines in which motion is given to a reciprocating sickle by a cam formed of an obliquely-grooved cylinder. 2. To a guard finger of peculiar construction. The object of the invention is to compensate for the wear of the cam, and thereby ensure a perfect cutting action of the sickle, and to obtain as direct an application of the power to the sickle as may be, and with as little friction as possible. The invention also has for its object the prevention of the gumming or clogging of the sickle. The invention is not described apart from the drawings. *Patent completed.*

2785. J. PLATT. "Improvements in mules for spinning." Dated December 4, 1858.

This refers to that part of the mules used for putting up the carriage, and consists in the application of an elastic part between the source of power and the carriage. Thus, supposing a scroll employed over which the band passes, the inventor attaches the said band to the carriage by an elastic connection. *Patent abandoned.*

2786. T. R. HARDING. "Improvements in combs, gills, hackles, and similar implements used in silk, wool, and flax machinery, and in the method of making the same." Dated December 4, 1858.

This relates, 1, to the making of flat pins, and consists in cutting off the pins in the forged or ground state previous to flattening, and feeding them into a machine consisting of one or more pairs of rolls, which may be so approached to each other as to give any degree of flattening required. It also consists in flattening pins only partially, the object being to have them so flattened that they may be driven into the stocks so as only to require one hole for each pin without requiring any morticing. It also consists in using flattened or partially flattened pins in machinery in which the pins are soldered on the stocks in lieu of the rounded pins. *Patent abandoned.*

2787. J. JOBSON. "Improvements in the manufacture of stoves and fire-places." Dated December 6, 1858.

This relates to connecting together the cast-iron plates and other cast parts of stoves and fire-places. The patentee casts one plate or piece with a boss or projection of triangular or other form, and smaller at the top than at the base. He casts the other piece which is to be connected to it with a hole or cavity of corresponding form to the boss, so that when placed over the boss the two pieces are in their proper relative position, and the boss passes nearly but not quite through the other piece. A wrought-iron screw is placed in the mould when the boss is cast and thus becomes fixed in the boss; or it may be afterwards tapped into the boss. A washer is placed over the screw when the two pieces of metal are placed together and a nut is screwed upon it. *Patent completed.*

2788. J. G. ARNOLD. "Improvements in envelopes for letters and similar purposes." Dated December 6, 1858.

This consists, 1, in forming the piece composing the envelope from the sheet or roll so as to leave the end of the sheet, which is made wider than the proposed length of the envelope, in a shape such that the next piece shall be cut off without any or with but little waste of material. 2. In making the adhering parts closing the sides or ends to consist of narrow folds that shall come inside between the face and back when the envelope is folded, leaving the back whole and smooth. *Patent completed.*

2789. B. NICOLL. "Improvements in agricultural machinery for all kinds of crops, chaff, turnip, and other root-cutting, and for the purposes of hay-making, and rubbing corn and seed from the stalks (instead of threshing)." Dated December 6, 1858.

This consists of a framework running upon wheels having a row of cutters of peculiar form, each cutter working on a joint. Attached to the framework are endless canvasses which, by a mechanical contrivance, convey the crops at the time of cutting to any required position. *Patent abandoned.*

2790. J. and F. MUIR. "Improvements in ornamental or colour printing." Dated December 6, 1858.

According to this process, supposing there to be five colours in the design, the first two are printed by corresponding blocks as usual. The other three colours are put on from a single sieve or colour box, that is to say, from a sieve on which the three several colours to be printed are laid in stripes at pre-determined positions. In this way as the block is laid upon the sieve it takes up the three colours on the pre-determined portions of the figure, and when applied to the surface to be printed, deposits its three several colours so as to form actual integral or detail portions of the pattern. There are modifications included. *Patent abandoned.*

2791. G. SNELL. "Improvements in machinery or apparatus for cutting woollen fabrics." Dated December 6, 1858.

In the "perpetual cutting machine" the patentee constructs and arranges the framework so as to allow of an additional cutting cylinder, by which he is enabled to make two cuts at one and the same time. *Patent completed.*

2792. J. DAWSON. "Improvements in machinery or apparatus for raising the nap on woollen cloths." Dated December 6, 1858.

This consists in passing the fabric over an arrangement of rollers in connection with the raising cylinders. The apparatus is self-acting. *Patent completed.*

2793. D. B. WHITE. "Improvements in indicating gauges." Dated December 6, 1858.

This consists in the use of a syphon or bent tube containing a short column of mercury, disposed so as to balance a longer column of water, or other fluid lighter than mercury, the lengths varying according to their relative specific gravities. The apparatus is intended to be applied in the "waste" of a ship, or similar situation, the tube containing the longer column being continued upwards into the cabin, so that an increase in the depth of the fluid to be gauged may be indicated by the disturbance of the equilibrium which before existed, and the consequent movement of the upper surface of the lighter fluid, the amount of which may be observed upon a scale contiguous to such surface. The apparatus may also be used to indicate the existence of fire, or of an increased temperature at a distance above or apart from its actual locality, *Patent completed.*

2794. R. A. BROOMAN. "Improvements in the

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manufacture of gloves." (A communication.) Dated December 6, 1858.

This consists in cutting out the main piece of the glove by machinery of such form that by turning over two projecting side-pieces they will form the fore-finger and little finger, and in then cutting out and sewing to the main piece, additional pieces to form the backs of the middle fingers, and part of the back of the glove, another piece to form the thumb, and another to form the wrist piece. *Patent completed.*

2795. F. W. FLETCHER. "Improvements in bolts for securing doors, and for other similar purposes." Dated December 6, 1858.

This consists in, and the patentee claims, the adaptation of excentric motion in any form whatsoever to all bolts for securing doors, and for other similar purposes. *Patent completed.*

2796. E. W. SCALE. "Improvements in railway and other brakes." Dated December 6, 1858.

This consists in the application of a spiral worm or screw fixed on the axle of the wheel to be operated on, and which may be made to lock the wheels of adjacent plain angles. *Patent abandoned.*

2797. J. E. BOYD. "Improvements in the construction of taps, valves, cocks, spiggots, or other apparatus or instruments for gauging or for drawing off the liquid or fluid contents of any cask, butt, vat, barrel, or other vessel." Dated December 7, 1858.

The patentee constructs a tap, valve, or cock, so as to cause it to indicate, whether the vessel containing the fluid be full or otherwise, and always exhibiting during the progress of consumption the progressive decrease, and he, therefore, attaches to any valve, tap, or cock a hollow tube of glass or other material, such tube to be in connection with the liquid to be gauged. The tap, &c., is to be so shaped by means of a bent or curved shank, that, on being placed in the vessel, it will descend into the lowest part thereof, the opposite end or external aperture of the tap to be the longest, so as to afford the advantages and combine the principles of the syphon. *Patent completed.*

2798. W. A. GILBEE. "An improved portable bath." (A communication.) Dated Dec. 7, 1858.

The lower part of the bath is here composed of two iron or wooden frames, filled in with sheet zinc, the two ends being composed of similar frames and sheet zinc. The upper edge is made of round iron rods, which are connected in the middle to the head frames by iron collars. The extremities of these rods are curved and provided on each side with small pins or bolts, which are introduced into holes made in the uprights on each side. The sides of the bath are filled in with moveable sheet zinc, or with a metal trellis. When the form of the bath is obtained, the inventor places in it a bag or cover of india-rubber so as to fit the interior of the bath framework, and the edges of the bag are brought down and secured to the outer sides by springs and knobs. A tap fitted to a pipe passing through the india-rubber bag serves for letting off the water. *Patent abandoned.*

2799. C. WILLIAMS and W. ELLISON. "A new mode or method of securing and liberating the corks and stoppers of bottles." Dated December 7, 1858.

This consists in passing a pin through the neck of the bottle, and also through the cork or stopper. *Patent abandoned.*

2800. J. WHITELEY and T. KITCHENMAN. "Improvements in press plates or apparatus employed in hot pressing woven fabrics." Dated December 7, 1858.

This consists in forming a passage running first along with and near to the edge of the plate, and then continuing at a suitable distance further from the edges of the plate, and so on in a spiral like direction, each circumrevolution approaching nearer to the middle of the plate in a suitable ratio; it is then returned between the passages and continued to the outer edge of the plate again. By this method the inventor can so adjust the distances respectively of the passages as to obtain and maintain a more equal effect upon the fabrics. *Patent abandoned.*

2801. W. MADDERS and J. WADDINGTON. "Improvements in machinery or apparatus for embroidering woven fabrics." Dated December 7, 1858.

Here the inventors make the holes of different sizes according to the required design, by fixing two or more stops or catches on the frame of the machine, so as to stop the carriage at any stated point, or to regulate the distance it must move, and thus also regulate the distance the stillettoes must pierce the fabric. The stillettoes being of a conical shape, it is evident the farther they are forced through the fabric, the larger the holes will be, and *vice versâ*. *Patent abandoned.*

2802. J. J. HARRIS. "Improvements in apparatus for refrigerating and regulating the temperature in worts and beer, which may be also employed as condensers in distilling." Dated December 7, 1858.

This consists in fitting in a suitable vessel through which the wort or beer is to flow, an apparatus consisting of a series of narrow hollow chambers or rows of pipes placed upright, and so connected together that water shall flow through them, and from one chamber or row of pipes into the next, and so on through the entire series. *Patent abandoned.*

2803. J. G. E. LARNED. "Improvements in the construction and arrangements of the boilers and working parts of steam fire-engines, part of which is applicable to engines for other purposes." Dated December 7, 1858.

This consists in constructing a boiler with sets or pairs of vertical tubes arranged annularly, the outer tube being in size in respect to the inner tube about as 2¼ inches to 1¼, and the annular space between such tubes being occupied by water. The inner tube is an air tube, and through it the air passes, and also round about the outer tubes; the fire is thus brought in contact with both sides or surfaces of the water. The furnace is also composed of tubes set close together, and opening at bottom into a ring-shaped water bottom and into the steam drum above. This construction of boiler can be applied to engines of various kinds. The invention further consists in the combination and arrangement of the working parts of the machinery for transmitting power from the cylinders through an intermediate shaft to the driving wheels, and the combination of such intermediate shaft with any suitable hydraulic apparatus, whether a rotary pump centred on such shaft, or a reciprocating pump operated by cranks on such shaft, which in such case becomes a crank shaft or axle, and also serves for steering the carriage. *Patent abandoned.*

2804. J. V. SCARBOROUGH. "Improvements in apparatus for the manufacture of boots and shoes." Dated December 7, 1858.

This relates to boots and shoes having soles and heels of gutta-percha. The invention consists in moulding the sole and heel of the boot or shoe so as not to require any subsequent trimming. *Patent completed.*

2805. J. HASLAM and J. LUTENER. "Improvements in healds used in looms and dressing frames." Dated December 7, 1858.

This relates to metal healds for weaving, and also to the application of healds composed of metal to dressing frames used in preparing yarns for the loom. It consists in the use of several flat thin strips of metal, having two holes in their flat sides, one at or near the top, and the other at or near the middle of the strip. The top hole admits of the passage of a wire which suspends the strips side by side in a row, whilst the middle hole is for the warp to pass through, which it does sideways, the hole being made at right angles to the direction of such threads. The second strips are kept from moving forward or backward at their lower ends by a wire placed on either side of them at or near their lower extremities, whilst at the same time the metal strips or healds are free to be adjusted laterally. In respect to dressing-frames the invention consists in the substitution of metal healds for those hitherto used. *Patent abandoned.*

2806. W. BURNESS. "Improvements in pumping and forcing liquids." Dated December 7, 1858.

This consists in combining with machines used for pumping liquids apparatus to render the flow of the liquid uniform, notwithstanding the intermittent action of the pumping or forcing machines. For this purpose the liquid as it passes from the pumping machine is caused to enter a cylinder containing a piston of large area, and having guides to insure its rising and falling truly within the cylinder. This piston is heavily weighted. The pipe for conducting the liquid away is connected directly with the cylinder, and while the pumping is going on a uniform flow is maintained in the pipe, the rise and fall of the weighted piston compensating for the want of uniformity in the action of the pumping machine. *Patent completed.*

2807. S. W. PUGH. "Improvements in obtaining and purifying naphtha, paraffine, and other oils, and also spirits." Dated December 7, 1858.

In obtaining paraffine oil the invention consists in operating upon bituminous coals when they are mixed with charcoal made from gas, pitch, and blood, chalk, lime, or other earthy matters; also any of the oxides of iron or other metallic carbonates or hydrates. The coal, &c., is to be placed in retorts, and operated upon by heat according to the method of conducting destructive distillation. The paraffine oil thus obtained is purified in the following manner:—The oil is placed in an iron vessel coated with zinc, and treated with from 10 to 20 per cent. of sulphuric acid, and the whole well stirred. When it has well settled, the oil is drawn off into another iron vessel and treated with a solution of caustic alkali, caustic lime, and chalk, and the whole well stirred to neutralise the acid. The oil is then drawn off into another vessel and bituminous charcoal, or peat charcoal, chalk, or lime and water containing oxide of iron is added in the proportion of from 6 to 10 gallons of this mixture to every 100 gallons of the oil; steam heat is then applied and the whole boiled for four or six hours, after which the oil is well washed with a strong solution of chloride of sodium, or a strong natural brine, then distilled in an improved apparatus in which it is proposed to employ three cylinders or stills placed side by side, and fitted in a manner which is not intelligibly described apart from the drawings. *Patent abandoned.*

2808. J. FERRABEE and F. H. ENGLAND. "Improvements applicable to machinery for carding, scribbling, and condensing wool and other fibrous substances." Dated December 7, 1858.

Here the doffers of condensers and carding and scribbling engines are covered with wire card in the same way as ordinary doffers, and by means of a certain tool the card surface is divided into the requisite number of rings by depressing annular portions of the wire surface and thereby forming a series of grooves: the wire so depressed may be retained by a series of bands of leather if found desirable. By this means perfect uniformity in the rings is secured, and the risk of their shifting and getting irregular when being ground is obviated, and a more even sliver is produced. The rubbing rolls of condensers are constructed by threading a number of rings of vulcanised india-rubber or leather on a turned hollow iron, and are received at the ends by washers. For grinding the doffer cylinder in its place the patentees construct a traversing grinder and mount it in bearings fixed on the framework of the machine so as to render the removal of any portion of the machinery unnecessary when grinding the doffer. In feeding scribbling or carding engines they take the roping from the traversing feeder by means of a roll with an endless belt running above it which delivers the roping or sliver to the feed rolls. To obtain such a distribution of the wool or staple as will ensure uniformity of sliver they apply apparatus for laying the fleece (as it is stripped from the doffer of the scribbler or carder) in layers one above the other to any required thickness upon an endless band or table, and thus to form a continuous sheet or vat which will be fed into the succeeding machine continuously at right angles, or any other angle, to the feed rolls of such engine. *Patent completed.*

2809. M. A. F. MENNONS. "An improved apparatus for ascertaining and registering the work of certain kinds of lever balances." (A communication.) Dated December 7, 1858.

This consists in a registering apparatus to be used in combination with the ordinary steelyards or plate and lever balances, known on the continent as "Bascules à Romaine," the work of which is, by the aid of this arrangement, ascertained and printed in figures corresponding to the weight of the charge. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 9, 1859.

1402. W. Burness. Improvements in steam-culture machinery, part of which is applicable to steam cartage and other purposes.

Dated June 16, 1859.

1450. T. W. Jones. Stereoscopic glasses for single pictures.

Dated June 18, 1859.

1472. J. Firth and J. Crabtree. Improvements in the manufacture of carpets.

Dated June 21, 1859.

1494. L. D. Owen. Improvements in machinery for manufacturing bolts and nails. A communication.

Dated June 27, 1859.

1532. R. Dick. Keeping accounts current in printed form, for addressing cards, circulars, papers, and periodicals of all kinds, with great rapidity, by the aid of a very simple machine, which is a constituent part of this invention.

Dated June 28, 1859.

1539. W. E. Newton. An improvement in variable cut-off gear for producing expansion in steam and other motive engines. A communication.

1541. J. M. J. Baillie. A new process for tanning hides and skins. A communication.

Dated June 29, 1859.

1542. J. Nash. An improved disengaging block.

1543. G. Hall, jun. Improvements in reaping machines.

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1544. A. McDougall. Improvements in the preparation of disinfecting and antiseptic substances.

1547. W. Wilkinson and D. White. Improvements in apparatuses for holding, regulating, compressing and burning gas, and other gaseous fluids, part of which apply to the holding of liquids.

1548. I. Tirebuck. Improved machinery for printing from engraved plates.

1549. W. J. T. Williamson. Improvements in gas burners.

1550. G. Chapman. Improvements in knitting machines.

1551. J. J. Griffin. Improvements in gas furnaces suitable for fusing refractory metals.

1552. G. Baker. Improvements in the manufacture of metallic lattice or trellis work. A communication.

Dated June 30, 1859.

1553. E. Francis. Apparatus for facilitating the "making up" or the packing of sugar, and other articles of grocery and other substances.

1555. R. Kay, J. Manock, J. Whittaker, and T. Booth. Improvements in machinery for slubbing, roving, spinning, and doubling cotton, and other fibrous materials.

1556. W. Bestwick. Improvements in crinoline-steel for ladies' dresses, skirts, and other similar purposes.

1557. R. A. Brooman. Improvements in lithographic and chromolithographic presses. A communication.

1558. L. Boigeol. Improved machinery for winding and twisting fibrous materials.

1559. T. Bell. Improvements in the manufacture of manure.

1562. J. A. Wilkinson. Improvements in printing presses, and apparatus connected therewith.

1563. W. Summerscales, sen., and J. Summerscales. An improved wringing and mangling machine.

1564. J. Bernard. Improvements in uniting certain parts of boots and shoes, and in the means employed therein.

Dated July 1, 1859.

1565. J. R. Beard. Improvements in the manufacture of artificial whalebone, applicable to umbrellas, parasols, stays, hats, bonnets, reeds, crinolines, and other similar purposes.

1566. A. Jones. Improvements in machinery or apparatus for drawing-in, twisting, or looming textile materials.

1567. B. Standen. Improvements in the deodorizing and separation of fecal and putrescent organic matters, in the preparation or manufacture therefrom of a portable artificial manure or fertilising compound, and in apparatus to be employed in such preparation or manufacture.

1568. A. Carron. An improved loom for the manufacture of silk and other velvet. A communication.

1569. N. Ardaseer. An improved method of making steam-boilers.

1570. J. B. Howell. Improvements in the treatment of iron.

1571. E. W. Carter. Improvements in machinery or apparatus for sewing.

1572. E. A. Wood and M. D. Rogers. Improved apparatus for raising and lowering boats.

1573. S. Fisher. Improvements in ordnance and projectiles.

1574. R. Royds and A. Harcourt. An improved composition for protecting the bottoms of ships and other structures of iron.

1575. W. Riddle. Improvements in advertisement show cards or boards.

1576. W. E. Kenworthy. Improvement in purifying gas, and saving of lime in the said purifying.

1577. M. Bogg. Improvements in washing machines.

Dated July 2, 1859.

1578. C. H. Pennycook. Improvements in ventilators and ventilating flue or chimney tops.

1579. R. W. Morville. Improvements in mechanism, or arrangements for suspending and securing window sashes. A communication.

1580. T. J. Hart. Improvements in breech-loading fire-arms.

1581. C. G. Guy, J. Brough, and R. Cotton. An improved upright steam boiler.

1582. E. Fourmaux, jun. A new weaving-loom.

1583. C. H. G. Williams. Improvements in dyeing fabrics and yarns.

1584. H. Hirsch. Improvements in screw propellers.

1585. H. Harris. An improved method of connecting together the parts of which bedsteads and other furniture are composed.

Dated July 4, 1859.

1586. J. Simon. A composition named zeiodelite, a kind of paste which becomes as hard as stone, is unchangeable by the air, and being proof against the action of acids, may replace lead and other substances for various uses.

1587. J. Hollingworth. Improvements in machinery or apparatus for the manufacture of paper.

1588. R. Lane. Improvements in mills for grinding grain and other materials.

1590. R. A. Brooman. An improved hemmer, or apparatus to be used in connection with sewing machines, for turning over and presenting the edge of the material to be hemmed properly to the needle. A communication

1591. R. A. Brooman. A cementing powder or mixture, and process for cementing, converting, refining, strengthening, and steelifying iron. A communication.

1592. A. V. Newton. An improvement in the process of, and improved apparatus for, separating metals from their ores. A communication.

Dated July 5, 1859.

1593. J. McIntosh. Improvements in the manufacture of leather driving belts.

1594. W. Knapton and A. Aitchison. Improvements in the manufacture of gas.

1597. W. E. Newton. Improved apparatus for moving iron or other metals while the same is in process of manufacture at the rolls. A communication.

1599. J. Watkins and J. Pugh. Improvements in lubricating wheels.

Dated July 6, 1859.

1601. J. Luis. An apparatus for washing wool, manufactured or not, and all other matters. A communication.

1603. J. Horton. A new or improved gas-meter.

1605. S. B. Haskard. Improvements in the manufacture of hook guides used in machines for the making of lace or other fabrics.

1607. L. Schwartzkopff and F. C. Philippson. Improvements in steam hammers, and in machines for cutting files, and for planing and grooving iron, stone and other substances.

1609. J. T. Edmonds. Improvements in winnowing or corn cleaning machines, parts of which are applicable for other screening or sifting purposes.

Dated July 7, 1859.

1613. J. Knowelden and D. Edwards. Improvements in hydraulic engines and pumps, and the employment of apparatus for applying motive power.

1615. Sir F. C. Knowles, Bart. Improvements in making iron castings.

1617. W. Robinson. Improvements in cask washing machines.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1621. W. Wait. Manufacturing bonnets, hats, and other articles, partly or entirely from the leaves of the palm tree or other flat or thin material. Dated July 8, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, July* 19, 1859.)

588. R. Leake and M. Sykes. Furnaces.
595. J. Aspinall. Evaporating in vacuo.
601. A. Booth and A. Booth, jun. Tags for laces.
605. J. N. Ryder. Preserving fruits.
612. J. R. Nicholson. Needles.
616. J. Cooke. Giving signals.
626. R. Hellard. Reaping and mowing.
627. S. Wheatcroft. Goffering machines.
629. F. Clarke. Preparing peat.
631. J. Cunliffe, F. Piggott, and G. Mallinson. Woven fabrics.
636. J. Thornton. Bricks, tiles, &c.
640. R. Waller. Joining leather.
648. J. S. Dawes. Collecting night soil.
649. W. Langton. Keys and wood fastenings.
650. C. Desurmont and C. Goudeau. Looms.
663. J. Fuller. Churns.
673. C. Garnett. Ginning cotton.
681. A. Warner and W. H. Tooth. Iron.
700. J. W. Hart. Destroying insects. A communication.
709. W. Hudson and C. Catlow. Looms.
733. C. A. Watkins. Brushes.
754. H. Rigby. Motive power.
758. W. E. Newton. Ovens. A communication.
789. H. Moss and T. West. Cutting leather, &c.
812. A. V. Newton. Furnaces. A communication.
830. A. Paget. Looped fabrics.
893. J. Martin. Bonnet fronts.
911. D. Doig. Gas lamps. A communication.
1014. C. Mansel. Travelling case.
1086. J. Morison and J. Morison, jun. Looms.
1142. T. Jones. Heating and ventilating.
1243. H. Newman. Artificial teeth.
1287. J. Harmer. Gas-meters. Partly a communication.
1320. W. H. Graveley. Aerating sea water; cooking and baking.
1347. A. Suter. Furniture castor.
1387. P. Salmon. Valves.
1480. R. Laming. Purifying gas.
1493. A. Parkes. Cylinders and tubes.
1494. L. D. Owen. Bolts and nails. A communication.
1541. J. M. J. Baillie. Tanning. A communication.
1584. H. Hirsch. Screw propellers.
1587. J. Hollingworth. Paper.
1605. S. D. Haskard. Hook guides.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 13, 1859.

120. J. Barrans.

Sealed July 15, 1859.

128. J. Eccles.
143. R. G. Salter.
144. G. and J. Collier.
149. G. Hamilton.
151. C. D. Archibald.
152. R. A. Brooman.
156. W. Trotter.
160. P. A. Sparre.
162. E. T. Hughes.
164. E. Stevens.
166. W. Poupard.
171. H. Hilliard and T. Chapman.
172. A. Lindo.
176. S. Phillips.
189. R. Howell and R. J. Willder.
245. T. Hartshorne.
252. G. F. Bradbury and J. J. King.
256. W. Robertson.
301. S. Tearne.
336. T. R. Ayerst.
496. S. Russell.
511. T. C. & G. J. Hinde.
556. W. E. Newton.
986. C. Batty.
1004. J. Davies.
1009. G. Roberts and J. Bridges.
1043. H. Allman.
1160. F. V. Hadlow.
1167. W. F. Nuthall.

Sealed July 19, 1859.

161. T. Clarke.
163. J. Whitehead.
179. J. Bent.
185. L. Le Prince.
194. J. H. Hume.
197. J. Newman.
206. T. W. Rammell.
208. R. Barter.
216. J. Fowler, jun., R. Burton, D. Greig, and J. Head.
276. J. Robertson.
281. L. Rigolier.
328. J. Honeyman.
432. A. V. Newton.
926. R. Coleman.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1660. W. and J. Clibran.
1670. H. Turner.
1674. T. Duncan.
1683. J. Cartwright.
1684. G. Jacque.
1701. J. L. Crockett.
1705. J. L. Crockett.
1758. G. Collier and J. and J. W. Crossley.
1767. W. Wood.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending July 16, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
2556	0 7	2821	0 3	2830	1 3	2840	0 3	2850	0 9	2860	0 7
2771	0 8	2822	0 10	2831	0 3	2841	0 3	2851	0 10	2861	0 3
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2814	0 3	2824	0 3	2833	0 3	2843	0 7	2853	0 6	2863	0 6
2816	0 3	2825	0 6	2834	0 3	2844	0 3	2854	0 7	2867	0 7
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2818	0 5	2827	0 6	2837	0 6	2846	0 3	2857	0 3	2866	0 10
2819	0 6	2828	1 2	2838	0 9	2847	1 4	2858	0 10	2868	0 10
2820	0 3	2829	0 10	2839	0 3	2849	0 4	2859	0 6	2869	0 10

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JULY 29, 1859.

THE NEW COINAGE.

IT is with a feeling of proud gratification that we observe set down as an item in the just published Miscellaneous Civil Estimates, Branch VII, the sum of £50,000 for a new Copper Coinage. It will be within the remembrance of our readers that this journal has for months past been urging the Government of the day to commence a reform of the inferior metallic currency of the kingdom, which has become so deteriorated by wear and tear and ill-usage as to be positively a disgrace to the community amongst whom it circulates. Our exertions have evidently been effective in the quarter where it was intended they should tell, and we record the fact with much pleasure. Fifty thousand pounds represents the purchase money of something like five hundred tons of copper, and these converted into coin would give an enormous number of individual pieces —say one hundred millions of the different denominations. This is a fair instalment, therefore, for a commencement; but we shall expect the vote of £50,000 to be an annual one for several years to come, if the reform is to be made complete.

No doubt there will be a considerable diminution in the *weight* of the new coins as compared with those now in use—at least there *ought* to be—and if instead of "Copper," "*Bronze*" might be read in the estimate, that also would be an improvement. However, with the Mint will rest probably the questions of size, weight, impression, and material, and that establishment will, we should think, know how to answer them.

THE STEEL MANUFACTURE REVOLUTIONIZED.

WE shall not, we believe, exceed the truth in saying that the steel manufacture of this and other countries is on the point of being revolutionized. More than six months since we announced the arrival in this country of the patentee of an important American invention having the improvement of that manufacture for its object; but, notwithstanding the successful establishment of the invention in America, we deemed it prudent to defer noticing the fact with much prominence until a course of actual experiments in our own country had dispelled the doubt which, not without reason, we always feel when novelties of great pretension reach us from the other side of the Atlantic. That course of experiments has now, however, been proceeded with, and the results obtained are so extraordinary, and so momentous, that we cannot longer delay to apprise the public of them. As the savings arising from the new process will, in all probability, in the course of a very short time, be reckoned by millions of pounds sterling, we are not surprised to find that funds amounting to hundreds of thousands of pounds are already being subscribed for the purchase and carrying out of the invention.

The impurities with which Mr. Bessemer, as he has lately informed us, has experienced the greatest difficulty, and those which so long retarded the progress of his remarkable invention, were sulphur and phosphorous; and, curiously enough, sulphur and phosphorus are precisely those impurities which Mr. Farrar, the inventor of this much more remarkable process, has more especially aimed at removing throughout his proceedings—with how much success we have already implied. Among the specialities of the new process are, first, economy of time in the manufacture by direct conversion of the iron in the crucible in three hours, doing away entirely with the tedious process of cementation, which takes from ten to twenty days. Secondly, from the same irons as are used under the old method, the inventor produces a superior steel of a more uniform character, possessing more tenacity and ductility; and from any given quantity of iron the *same quantity* of any required grade of steel, there being no loss in the melting. Thirdly, he purifies iron from all foreign substances by means of chemicals, and thus makes available for good cast steel a lower grade of iron than can be used in any known method. Fourthly, the cost of producing any kind of steel will be simply the cost of the bar-iron used, added to which must be the same expense as is now attendant upon producing it from "blister-steel," *i.e.*, melting, hammering, rolling, &c. Fifthly, the process has also the great advantage of enabling parties to make malleable castings from ordinary wrought iron, or wrought iron scrap, a mode of manufacture which is peculiarly adapted for railway carriage wheels, and other castings requiring great strength, both tensile and other. This material is also adapted for gas and water pipe couplings, for which annealed cast iron castings are now used, and possesses infinitely more strength; it is likewise suitable for light ordnance, and any castings under 30 cwt. The patentee does not claim to make the best steel out of poor irons. The two great enemies of iron are, as we have intimated, sulphur and phosphorus, which, from the chemicals used, pass off in a nascent state.

The Damascus Steel and Iron Company of New York are now making from three to six tons of best cast steel per day out of American iron by this process, producing finished bar-steel at a cost not over £28 a ton of a quality equal to that made here out of the best brands, costing in iron bar £30 to £36 a ton. From an iron puddled by the Damascus Company direct from the ore, and by Anthracite coal, they are producing a steel sufficiently good for the best machinery steel, and saws, &c. The iron costs not more than £8 a ton, and, when manufactured by this process, not more than £20 a ton.

It is said that good steel cannot be made of common iron; nor can that be done, unless the iron is first purified of foreign substances, and thereby brought up to a better grade of iron, and better adapted for steel purposes. There are some irons in which it is impossible to reach all the impurities, viz., those containing much arsenic; with these the method would fail; but it is a fact, that for all second and third class steels there is plenty of English iron, and the second and third grades of Swedish iron are good enough for the very best steel.

Files, and many other descriptions of articles made from steel manufactured under the new process, are already in the market, and are producing no little excitement in Sheffield and other places. The reduction in the price of the steel thus made is so great that the "consumers" of steel are making numerous and increased applications for it daily; so that the demand is at present much greater than the supply that can be kept up. Vastly enlarged arrangements are, however, in contemplation. We will add but one testimonial only to the quality of the new and cheap steel. The proprietor of a very large manufacturing establishment, in a letter now before us, says:—"We "have tried some of the steel made here by "Mr. F—— for gun-barrel boring, which is a "very severe test for steel, and it has proved "superior to anything we ever had, for which "our price is £65 per ton." Under the new process the best steel can be produced for less than £28 per ton.

THE LAYING OF SUBMARINE TELEGRAPH CABLES.

OF all the difficulties which beset the establishment of long submarine telegraph lines the greatest are those experienced in the submersion of the cable. We have all heard the tale of the repeated attempts to lay the Atlantic cable, and of the constant risk and fear of failure under which it was at last deposited. The knowledge of these facts urges us to ask why it is that no step has been taken towards the trial of a plan which has been fully explained in our pages—which was designed by an esteemed naval officer—which removes most, if not all, of the difficulties hitherto experienced—and which has been the subject of the repeated commendation of nautical men and engineers! We refer to Captain J. H. Selwyn's patented method of employing large drums or cylinders floating on the water and carrying the cable. Hitherto we have heard no objection offered to the advantages which he claims for it. If its novelty be an objection, we may say farewell to all possible improvement. Nothing can be more simple or, as he shows, less expensive; and the Atlantic Telegraph Company, or their contractors, would perhaps do well to give the principle a fair trial before reverting to means which have so often failed. With whatever modifications it may be adopted, there are fundamental errors in the process of paying out coils of cable which no system of brakes can do other than aggravate, and there is also the risk of a gale during the operation, for which no process of laying, save that of Captain Selwyn, provides in any adequate way. The danger to the crew—no small consideration—is in his plan entirely obviated. Further, while the Admiralty might be disposed to assist in a mode which only requires the services of steamers in towing, they would certainly refuse such aid if involving so large an expenditure as that which was necessary for the Agamemnon's fittings and repairs (£40,000 sterling), and which—or some sum proportioned to the size and weight of the new cable—would otherwise have to be borne by the contractors, and eventually by the shareholders.

Some new means must also be adopted for the raising of the old cable, for while no great length has ever been recovered in the various attempts made for that purpose, which have always resulted in breakage, even supposing it were possible to do it, the time necessarily employed with a steamer would be so great as to do away with all hope of a profit from the operation. The cylinders seem in this direction, as well as in the laying, to offer probabilities of success which at least justify a fair trial. The drum, it is evident, in the case of raising, plays the part of a large capstain or winch, winding up the cable by the power applied to the paddles on a cylinder whose diameter is fifty feet, and therefore it will have far more chance of success, and occupy far less time than a steam-engine or other mechanical apparatus placed on a platform (the ship's deck), which is liable to sudden raising and lowering by the pitching of the ship, the engine-power being exerted irrespective of such motion, or the consequent strain on the cable. The idea of under-running by means of such a machine seems to us also a feasible one, at least for the three or four hun-

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dred miles of shoal-water near the coasts of Ireland and Newfoundland respectively; and it is possible that the whole fault might be discovered there, thus superseding the necessity for raising the deep portion at all.

To the Government, also, who have shown their intention to lay a submarine cable to Gibraltar, we would suggest that the question is a national one, and well worthy an attempt at solution by the means which, without any great extra expense, are at their disposal, before risking the large sum which has been voted for the cable on an attempt either by themselves or through contractors, at laying it from ships.

Indeed, it is difficult to understand how, in the cases of very large sums such as those here involved, any contractor can be found to risk the loss, in the present state of our knowledge of the difficulties attendant on deep-water laying. And how do the contractors show that in the event of their losing in laying a cable like the Atlantic, which costs say £300,000, their estate would afterwards be capable of paying a fine, or even repaying the sum advanced to carry on the work? Say the contractor fails—is that any satisfaction to the shareholders who want the interest of their money, or to the public who want the communication?

In conclusion, the whole subject deserves and should receive most careful consideration before next year, if any attempt is then to be made to revive what can never be allowed to remain dormant, since it has been proved practicable, viz., an electric communication with America, and no elucidation will be valuable which has not a due admixture of Practice combined with Theory. The laying of a cable is an operation which naval officers may be justly expected to manage more efficiently than landsmen, and we hope the experience of such men as Captain Preedy and others will be made available in future undertakings.

RIFLED GUNS FOR THE NAVY.

THE article on rifled guns for the navy which we last week published has not been without result. The unprofessional press helped to gain increased attention for our remarks, and Lord Lyndhurst patriotically availed himself of the first succeeding opportunity afforded him by his place in the upper house of Parliament, by questioning the first lord of the Admiralty upon the subject. "The question I have to put to "the noble Duke (of Somerset) is this," said he, "whether he is aware that the French are arm-"ing their fleet on the other side of the Channel "with rifled cannon? I put this question be-"cause from the reports I have heard it would "appear that the rifled cannon we are preparing "will not extend to above 100 in the present "year and 200 in the following year, whereas it "is said the French rifled cannon are manufac-"tured with such rapidity that they will be "able to arm their fleet in that mode long be-"fore we can make use, to any extent, of the "rifled cannon of Sir W. Armstrong." The reply given to this most serious inquiry was, we regret to say, calculated to remind us of the accustomed hauteur of noble functionaries, rather than to give us any kind of confidence in our armaments. The reports of the Duke of Somerset's answer to Lord Lyndhurst vary somewhat in the various morning papers, but the tenor of the whole is the same. We extract it as follows from the *Times*:—"He [the noble "Duke] had only to say that of course he had "heard the report, though that report was not "based on any authentic information in his pos-"session, that some rifled cannon had been pre-"pared in the arsenals of France. He was "aware also that although we had very many "improved cannon in the course of manufacture "our cannon would not be, according to our "system of manufacture, ready for many months "to come. But that was not the whole matter. "There were many questions connected with "the subject to which the inquiry of the noble "and learned lord referred. He did not, how-"ever, think it desirable that he should now "enter into a discussion of the questions con-"nected with the improvement of cannon, "which were now under the consideration of "the department to which they properly be-"longed. He therefore must decline to follow "the noble and learned lord into that discussion, "to show what we had done in that way in "answer to what the noble and learned lord "imagined the French had done."

Now, if this is to be taken as an example of the manner in which questions of great public moment—not to say questions of public safety—are to be replied to by the head of the Admiralty, the sooner the Admiralty loses its head the better. Is it not monstrous that a public functionary should be permitted to answer the plain and pressing question,—"Are we taking any step towards arming our navy with rifled guns, as the French are said to be doing?"—by the evasive remark that he, the first lord of the Admiralty, thought it undesirable that he should discuss the "many questions" connected with the "improvement of cannon" in the House of Lords! However ignorant the Duke of Somerset may be of the fact, we can assure him that the question which he thus contemptuously slights is agitating the thoughts of many able and patriotic officers of the navy, and other gentlemen, at this moment. We have had it from the lips of several of them, that, in their judgment, the policy of waiting for, and depending almost exclusively upon, the Armstrong gun is in the highest degree imprudent and dangerous.

We have no predisposition to panic in connection with our national defences, but we submit that the rapid armament of French vessels with rifled cannon, which is said in the best quarters to be now in progress, is a matter of the most momentous nature. And we further submit that if the Duke of Somerset have any genuine patriotism in him, and if he be in any way worthy to control the navy of the people of England at this crisis, he will not be content with saying he is without authentic information on the subject, but will at once bestir himself, and put himself in possession of such information, and act vigorously, if need be, upon it. If our informant and the statements of our greatest contemporary are to be relied upon, the French *are* rapidly producing large numbers of rifled cannon for the navy; and it will be perilous indeed for us if the first lord of our Admiralty is to be the last man in England to learn the fact.

Since the above was written the *Times* has been provoked by the Duke of Somerset to the publication of an article upon this subject. The editor says:—"The Armstrong gun will, no "doubt, be an astonishing weapon; but as yet "we have only one or two specimens of it. The "works are only in course of erection, all the "machinery has to be brought into order, and "the utmost that we are promised is a hundred "Armstrong guns by the end of the year. "Even this promise is hardly likely to be kept. "On the other hand, thousands of Armstrong "guns will be required for our ships, our "fortresses, and for service in the field. The "construction of these must be the work of several years. In the meantime what is going "on across the Channel? 'The most noticeable "'feature in the Arsenal,' writes our Marseilles "'correspondent, 'is the effort made to provide "'rifled ordnance for the Navy. The system "'which appears to be definitely adopted con-"'sists of three grooves about three inches "'broad and an eighth of an inch deep, with a "'twist of one-sixth.' These guns are being "supplied rapidly to the French line-of-battle "ships. It would certainly seem but a prudent "step to make use of the guns we have as sup-"plemental to the 'Armstrongs,' which must "be comparatively few in number for the next "two or three years. There are, we believe, no "less than 7,000 smooth-bored guns now "lying at Woolwich Arsenal. To rifle a part "of these would be an easy and, comparatively, "an inexpensive work. If beyond the powers "of the Government establishments, the work "might be distributed among the various facto-"ries in our great towns, and by the end of the "year large numbers of rifled guns might be fit "for use."

In another article we show that the Americans are adopting means for rifling their bronze ordnance.

It may seem strange to some to say so, but we do not hesitate to believe that the Lancaster gun is, after all, that to which we must look for a successful settlement of this question of rifled guns for the Navy. Those which burst in the Crimean war were merely ordinary service-guns turned out to an oval bore, and their failure in no way proved the principle bad. On the contrary, recent experiments have amply demonstrated the soundness of the principle. We know also that the Lancaster gun can be produced in large numbers with great rapidity. These two facts taken together justify us, we submit, in the confidence we feel in this extraordinary but simple weapon, which will, we are sure, speedily prove itself inferior to none in this or any other country.

THE NEW AMERICAN RIFLED CANNON.

THE Americans are not disposed to fall far behind the more belligerent nations of the Old World in their implements of war. At Chicopee, Massachusetts, experiments have lately been made with a new rifled cannon, the invention of General James, which promises extraordinary results. From a synopsis of the official report of the Board who superintended these trials, which has just reached us, we learn that the guns examined were a 6-pound bronze cannon, with 3·80 inch calibre, and rifled 15 grooves; a 12-pounder, 4-inch calibre and same number of grooves. In both instances, the twist in rifling was equivalent to one turn in 60 feet at the beginning, and ending in one in 20. The projectile designed by General James for these guns is a cast-iron cylinder pointed by a solid conoidal head, the diameter being only ·02 of an inch less than the bore of the gun, and the length twice the diameter of the calibre. The cylinder retains its full diameter for a quarter of an inch of its length at each end. For the intermediate length its diameter is reduced half-an-inch, forming a recess in its body, which is filled by a compound of canvas, sheet-tin, and lead. The base of the cylinder has a central cavity or opening of 1·95 inches in diameter, and 1·5 inches deep. When the charge is fired the gas evolved by the burning of the powder, in its efforts to expel the projectile and to escape from the gun, is forced into the cavity against the compound filling, which is thereby pressed into the grooves of the bore, and by its firm hold in them the rotary motion is imparted to the projectile.

The Board having examined the guns and projectiles, proceeded to test their efficiency, the results obtained being very satisfactory. The report says, respecting the guns, their merit is due to the rifling, which can be readily applied,

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at little cost, to all bronze cannon of the United States, and so render them as far superior to the present smooth bore guns as, in small arms, the most improved rifle surpasses the musket. The depth of grooving is so shallow as in no wise materially to impair the strength of the gun, while it is sufficient to compel the projectile to take the rifle flight. The effect of these contrivances was exhibited in an extraordinary manner, by the increased range obtained while using the same charge of powder and elevation in projecting masses of double the weight of the usual spherical balls. The merits of the projectile are represented to consist in their answering fully the expectations desired of them; their ready fabrication and adaptation to guns; their ease in loading; the certainty of the expansion of the filling and its firm hold in the grooves of the guns. The greased canvas wipes the rifling clean and leaves the bore in condition readily to receive the next charge, and which is also a sure protection to the bore from injury. For these reasons the gun and projectiles are commended to the favourable consideration of the Government; and as the experimental firing was subject to several disadvantages which may hereafter be avoided, the Board recommend that guns of the service calibre be granted to General James for rifling according to his principle.

We learn that another series of experiments is in contemplation, in which will be compared, side by side, the performances of this new gun with those now in use. Of course the remarkable precision and power of the new rifled ordnance constitute its chief value, but the great saving of ammunition effected is a matter of no small importance. The results of the experiments above referred to are expressed in tabular form, at much length. As an example, it is shown that in one instance 18 shots were fired a mean distance of 674 yards, at an elevation of one degree—the powder weighing 1¼ lb., the projectile 12¾—the deviation being only four inches to the right of centre, and half an inch above it. On reaching ground the missile was buried five feet in compact sand. In another instance a shot was fired 2,050 yards, at an elevation of five degrees, and passed about 25 feet above the top of the hill towards which it was directed. The Board believe, from the testimony of several witnesses who were near the range, that the projectile "continued its "flight many hundred yards beyond the hill," the summit of which was nearly on the same level as that upon which the gun was placed in battery. According to the statement of Mr. Ames, the manufacturer of the gun, who carefully examined the ground, "it is almost "certain the ball went four miles." After what is already known it is safe to say that any object within the reach of an ordinary spy-glass is a fair mark for this terrible weapon.

In one other respect the exploits of General James's gun demand attention. "According to "the laws of projectiles laid down in the Ordnance Manual, and which have long been "established, as was supposed beyond power of "refutation, the range of a 6 lb. shot at five deg. "elevation and 1¼ lb. powder is," says the *New York Journal of Commerce*, to which we are indebted for this information, "1,523 yards; but, "in the example now afforded, a ball 12¾ lb., "with the specified quantity of powder, has "gone between three and four miles. As com"pared with the celebrated Armstrong gun, the "results are not less curious. Mr. A. claims to "have thrown a ball 5¼ miles with six pounds "of powder, employing an area or calibre of 3¼ "inches—which is a result of 55-100ths less "favourable than that obtained by the experi"ments at Chicopee. According to the latter, "any gun of a calibre equal to Armstrong's will "throw a ball, with less than half the powder, "the full distance attained in his practice."

PRE-ADAMITE MECHANICS AND THEIR TOOLS.

A VERY curious controversy has lately sprung up among our geologists and antiquaries respecting the duration of man's past existence upon the earth, the occasion of it being the discovery in several places of various flint-implements which appear to have been the tools of some very ancient race of mechanics. These tools consist, first, of certain flint-flakes, shaped apparently for arrow heads or knives; secondly, of certain pointed flint weapons truncated at one end, and intended probably for lance or spear-heads; and, thirdly, of certain oval or almond-shaped flint implements with a cutting edge all round, which were used, it is thought, as sling stones or as axes. It has been found that in form and workmanship—for all seem to agree that they are products of work*man*ship—the two last classes differ essentially from the implements of what is called the Celtic period, which are usually more or less ground and polished, and cut at the wide and not the narrow end. All these flint implements have been discovered, very remarkably, in intimate association with the remains of *extinct* races of animals, and in undisturbed beds of drift of a geological period hitherto considered long antecedent to the existence of man upon the earth.

Mr. Joseph Prestwich, a Fellow of both the Royal and the Geological Societies, has lately furnished a paper to the Royal Society in which he very temperately states the facts hitherto ascertained in reference to these strange discoveries. He commences by noticing how comparatively rare are the cases even of the alleged discovery of the remains of man or of his works in the various superficial drifts, notwithstanding the extent to which these deposits are worked; and of these few cases so many have been disproved, that man's non-existence on the earth until after the latest geological changes, and the extinction of the Mammoth, Tichorhine Rhinoceros, and other great mammals, had come to be considered almost in the light of an established fact. Instances, however, have from time to time occurred to throw some doubt on this view, as the well-known cases of the human bones found by Dr. Schmerling in a cavern near Liège—the remains of man, instanced by M. Marcel de Serres and others in several caverns in France—the flint-implements in Kent's Cave—and many more. Some uncertainty, however, has always attached to cave-evidence, from the circumstance that man has often inhabited such places at a comparatively late period, and may have disturbed the original cave-deposit; or, after the period of his residence, the stalagmitic floor may have been broken up by natural causes, and the remains above and below it may have thus become mixed together, and afterwards sealed up by a second floor of stalagmite. Such instances of an imbedded broken stalagmitic floor are in fact known to occur; at the same time the author does not pretend to say that this will explain all cases of intermixture in caves, but that it lessens the value of the evidence from such sources.

The subject has, however, been latterly revived, and the evidence more carefully sifted by Dr. Falconer; and his preliminary reports on the Brixham Cave,* presented last year to the Royal Society, announcing the carefully determined occurrence of worked flints mixed indiscriminately with the bones of the extinct cave bear and rhinoceros, attracted great and general attention amongst geologists.

In 1849 M. Boucher de Perthes, President of the "Société d'Emulation" of Abbeville, published the first volume of a work entitled "An"tiquités Celtiques et Antédiluviennes," in which he announced the important discovery of worked flints in beds of undisturbed sand and gravel containing the remains of extinct mammalia. Although treated from an antiquarian point of view, still the statement of the geological facts by this gentleman, with good sections by M. Ravin, is perfectly clear and consistent. Nevertheless, both in France and in England his conclusions were generally considered erroneous; nor has he since obtained such verification of the phenomena as to cause so unexpected a fact to be accepted by men of science. There have, however, been some few exceptions to the general incredulity. The late Dr. Rigollot, of Amiens, urged by M. Boucher de Perthes, not only satisfied himself of the truth of the fact, but corroborated it in 1855 by his "Mémoire sur des Instruments en Silex "trouvés à St. Acheul." Some few geologists suggested further inquiry; whilst Dr. Falconer, himself convinced by M. de Perthes' explanations and specimens, warmly engaged Mr. Prestwich to examine the sections.

Mr. Prestwich, who confesses that he undertook the inquiry full of doubt, went last Easter, first to Amiens. On his first visit he obtained several specimens from the workmen, but he was not successful in finding any himself. On his arrival, however, at Abbeville, he received a message from M. Pinsard of Amiens, to inform him that one had been discovered the following day, and was left *in situ* for his inspection. On returning to the spot, this time with his friend Mr. Evans, he satisfied himself that it was truly *in situ*, 17 feet from the surface, in undisturbed ground, and he had a photographic sketch of the section taken.* Dr. Rigollot also mentions the occurrence in the gravel of round pieces of hard chalk, pierced through with a hole, which he considers were used as beads. Mr. Prestwich found several, and recognised in them a small fossil sponge (the *Coscinopora globularis*, D'Orb), from the chalk, but does not feel quite satisfied about their artificial dressing. Some specimens do certainly appear as though the hole had been enlarged and completed. The only mammalian remains Mr. Prestwich here obtained were some specimens of the teeth of a horse, but whether recent or extinct, the specimens were too imperfect to determine; and part of the tooth of an elephant (*Elephas primigenius?*). In the gravel-pit of St. Roch, 1½ mile distant, and on a lower level, mammalian remains are far more abundant, but the workmen said that no worked flints were found there, although they are mentioned by Dr. Rigollot.

At Abbeville, Mr. Prestwich was much struck with the extent and beauty of M. Boucher de Perthes' collection. There were many forms of flints in which he, however, failed to see traces of design or work, and which he only considered as accidental; but, with regard to those flint-instruments termed "axes" ("haches") by M. de Perthes, he entertains not the slightest doubt of their artificial make. They are of two forms, generally from four to ten inches long. They are very rudely made, without any ground surface, and were

* On the 4th of May, this year, Dr. Falconer further communicated to the Geological Society some similar facts, though singularly varied, recently discovered by him in the Maccagnone Cave near Palermo.—See Proc. Geol. Soc.

* On revisiting the pit, since the reading of his paper, in company with several geological friends, Mr. Prestwich was fortunate to witness the discovery and extraction by one of them, Mr. J. W. Flower, of a very perfect and fine specimen of flint-implement, in a seam of ochreous gravel, 20 feet beneath the surface. They besides obtained thirty-six specimens from the workmen.—June, 1859.

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the work of a people probably unacquainted with the use of metals. These implements are much rarer at Abbeville than at Amiens. Mr. Prestwich was not fortunate enough to find any specimens himself; but from the experience of M. de Perthes, and the evidence of the workmen, as well as from the condition of the specimens themselves, he is fully satisfied of the correctness of that gentleman's opinion, that they there also occur in beds of undisturbed sand and gravel. Besides the concurrent testimony of all the workmen at the different pits, which Mr. Prestwich after careful examination saw no reason to doubt, the flint-implements ("haches") bear upon themselves internal evidence of this opinion. It is a peculiarity of fractured chalk flints to become deeply and permanently stained and coloured, or to be left unchanged, according to the nature of the matrix in which they are imbedded. In most clay beds they become outside of a bright opaque white or porcelainic; in white calcareous or siliceous sand their fractured black surfaces remain almost unchanged; whilst in beds of ochreous and ferruginous sands, the flints are stained of the light yellow and deep brown colours so well exhibited in the common ochreous gravel of the neighbourhood of London. This change is the work of very long time, and of moisture before the opening out of the beds. Now in looking over the large series of flint-implements in M. de Perthes' collection, it cannot fail to strike the most casual observer that those from Menchecourt are almost always white and bright, whilst those from Moulin Quignon have a dull yellow and brown surface; and it may be noticed that whenever (as is often the case) any of the matrix adheres to the flint, it is invariably of the same nature, texture, and colour as that of the respective beds themselves. In the same way at St. Acheul, where there are beds of white and others of ochreous gravel, the flint-implements exhibit corresponding variations in colour and adhering matrix; added to which, as the white gravel contains chalk débris, there are portions of the gravel in which the flints are more or less coated with a film of deposited carbonate of lime; and so it is with the flint-implements which occur in those portions of the gravel. Further, the surface of many specimens is covered with fine dendritic markings. Some few implements also show, like the fractured flints, traces of wear, their sharp edges being blunted. In fact, the flint-implements form just as much a constituent part of the gravel itself—exhibiting the action of the same later influences and in the same force and degree—as the rough mass of flint fragments with which they are associated.

With regard to the geological age of these beds, Mr. Prestwich refers them to those usually designated as post-pliocene, and notices their agreement with many beds of that age in England. The Menchecourt deposit much resembles that of Fisherton near Salisbury; the gravel of St. Acheul is like some on the Sussex coast; and that of Moulin Quignon resembles the gravel at East Croydon, Wandsworth Common, and many places near London. The author even sees reason, from the general physical phenomena, to question whether the beds of St. Acheul and Moulin Quignon may not possibly be of an age one stage older than those of Menchecourt and St. Roch; but before that point can be determined, a more extended knowledge of all the organic remains of the several deposits is indispensable.

Mr. Prestwich next inquires into the causes which led to the rejection of this and the cases before mentioned, and shows that in the case of M. de Perthes' discovery, it was in a great degree the small size and indifferent execution of the figures, and the introduction of many forms about which there might reasonably be a difference of opinion; in the case of the arrow-heads in Kent's Cave a hidden error was merely suspected; and in the case of the Liège Cavern he considers that the question was discussed on a false issue. He therefore is of opinion that these and many similar cases require reconsideration; and that not only may some of these prove true, but that many others, kept back by doubt or supposed error, will be forthcoming.

One very remarkable instance has been already brought out. In the 13th volume of the "Archæologia," published in 1800, is a paper by Mr. John Frere, F.R.S. and F.S.A, entitled, "An Account of Flint-Weapons discovered at Hoxne, in Suffolk," wherein that gentleman gives a section of a brick-pit in which numerous flint-implements had been found, at a depth of eleven feet, in a bed of gravel containing bones of some unknown animal; and concludes, from the ground being undisturbed and above the valley, that the specimens must be of very great antiquity, and anterior to the last changes of the surface of the country—a very remarkable announcement, hitherto overlooked.

Mr. Prestwich purposely abstains for the present from all theoretical considerations, confining himself to the corroboration of the facts:—"1. That the flint-implements are the work of man. 2. That they were found in undisturbed ground. 3. That they are associated with the remains of extinct mammalia. 4. That the period was a late geological one, and anterior to the surface assuming its present outline, so far as some of its minor features are concerned."

He does not, however, consider that these facts, as they at present stand, of necessity carry back man in past time more than they bring forward the great extinct mammals towards our own time, the evidence having reference only to relative and not to absolute time; and he is of opinion that many of the later geological changes may have been sudden or of shorter duration than generally considered. In fact, from the evidence here exhibited, and from all that he knows regarding drift phenomena generally, he sees no reason against the conclusion that this period of man and the extinct mammals—supposing their contemporaneity to be proved—was brought to a sudden end by a temporary inundation of the land; on the contrary, he sees much to support such a view on purely geological considerations.

All are not, however, so temperate as Mr. Prestwich. Many have already taken sides upon the question; the one side contending that man—and man as a mechanic, too—is a much more venerable being than the other side will admit. We shall probably recur to the subject on an early occasion.

THE WORKING MAN: HISTORY OF HIS PROGRESS.

THE orthodox division of society amongst us English people is into three classes. The carriages of a railway-train are of three classes. The seats of a theatre are of three classes. In public print and talk three classes are acknowledged: middle, upper, and lower. This is quite right; there are three and only three; though which is highest and which lowest we cannot say, but should call him happiest who belongs to all of them. The three classes of society, then, are these: thinkers—workers—and another class, difficult to name, who are distinguished by character and beauty of demeanour and life, rather than by thought or action. Only as belonging to one or all of these classes are men to be revered or honoured. The history of the modern workman or handicraftsman—his ascent from serfhood to manhood—is the grandest fact in European history. The few great events that evolved this fact of facts were as the tollings of the hours on the world-dial, whose hours are centuries. We chronicle them here to set the reader's mind thinking of them afresh. But first, one word about the material to be wrought upon—the Teutonic race.

The strongest element in shaping a people's destiny is peculiarity of race. We have a signal example of this in the Gallic blood of our neighbours across the Channel. How excitable they are—mobile, quickly susceptible of change for better or worse. How sociable, communicative, wearing their secret on their tongue. How demonstrative to vainness, personal and national! What a generous, high-mettled people! Thus, 'tis said that Louis Philippe's Government fell in 1848, because it appealed to nothing generous and high in the people; based itself only on material interests; set up the cash-box and ledger for worship; warning against revolutions as bad for trade.

In tracing the history of Anglo-Saxon freedom we find the germ of it in the race. Tacitus, the first keen, cultivated observer of the German tribes, said of them that they were remarkable for personal attachment, trust in one another, devotion and loyalty to one another. This gravitation of man to man is the fountain of liberty. Infinite space makes not liberty; liberty is an *orbit* of one's own, springing from mutual attractions and reciprocities.

The earliest civiliser of our wild ancestors was the sight of the external civilisation of the peoples they conquered: Roman roads, aqueducts, towns, municipal institutions, civil laws.

Feudalism was the first social form into which modern Europe crystallised. Guizot thus pictures the owner of the fief or feud:—

"Let us examine feudal society as it is in its own nature, looking at it first of all in its simple and fundamental element. Let us figure to ourselves a single possessor of a fief in his own domain; and consider what will be the character of the little association which groups itself around him. He establishes himself in a retired and defensible place, which he takes care to render safe and strong; he there erects what he terms his castle. With whom does he establish himself there? With his wife and his children: probably, also, some few freemen who have not become landed proprietors have attached themselves to his person, and remain domesticated with him. These are all the inmates of the castle itself. Around it, and under its protection, collects a small population of labourers—of serfs, who cultivate the domain of the seigneur. Amidst this inferior population religion comes, builds a church and establishes a priest. In the early times of feudality, this priest is at once the chaplain of the castle and the parish clergyman of the village; at a later period the two characters are separated. This, then, is the organic molecule, the unit, if we may so speak, of feudal society."

In these feudal times, reaching from the 10th century to the 15th—the middle ages, as we call them—the workman was a serf, the property of his lord, a part of his goods and chattels. Much as the Teutonic personal devotion and loyalty modified this condition, the labourer was essentially a slave.

It is impossible to over-rate the power of the old Catholic church in those centuries. Fancy yourself in one of our old churches seven centuries ago, when high birth was the sovereign possession in Europe. The baron—rugged, valiant, proud—and the dull dim serf, in the chime of Sunday bells, have crossed heath and meadow in the summer sunshine: there under Gothic arches, in the light of the coloured window, rich as a July sunset behind English elms, in the hearing of these is read the old words, "Put on the new manhood, wherein is neither barbarian, Scythian, bond, nor free;

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"but intelligence and worth are all in all." That reader, in his person and in his book, represents self-discipline and gentleness amidst war and brigandism—genius, intelligence, and learning amidst pride of descent and brute force. No one in that building is higher than he, and he is perhaps the son of a herdman. The monastery he belongs to is the only haunt of learning in that whole region. There is better tillage of the earth there than on the baron's estate; a knowledge and skill of handicraft and manufacture wholly unknown elsewhere. There, too, is spoken and practised the grand sentiment for the industrial ages: *Bene laborare est bene orare;* To work well is to pray well.

This is no idle sentimentality about those old ages. It is a fact, growing clearer and clearer, that the old Catholic church was the first great civiliser and humaniser of modern Europe. In the middle ages she was the foremost fact. She literally saved and preserved the learning of antiquity; she fostered the nder and finer arts; she educated the serf to be a priest, or cardinal, or even pope; she stood between the serf and his lord; in one of her earliest quarrels with the nobility, her clergy were reproached as "the sons of serfs." And it has been well pleaded, that had she not been the huge European organism she was, she could not have checked the violence of kings and nobles.

It should be observed that in England the power of the feudal baron was a far more limited one than on the Continent. Norman William made his barons immediately responsible to him; allotted the land of each in places distant from each other; while, again, the people they had conquered were almost as strong as themselves: hence the closer union between the nobles and the people. The Magna Charta, wrung by the barons from John, was as much a people's as a nobles' charter.

Again, the first crusade was a great awakening of the people. Kings, chiefs, vassals, and serfs, were for the first time inspired with a grand aim in common. "That remarkable ex-"pedition was the first great event of modern "times which had a European and a Christian "interest—an interest not of nation, or place, "or rank, but which the lowest serfs had in "common, and more than in common, with the "loftiest barons. When the soil is moved, all "sorts of seeds fructify. The serfs now began "to think themselves human beings."*

How finely M. de Tocqueville depicts this movement of liberty. "The erection of corpo-"rate towns introduced an element of demo-"cratic liberty into the bosom of feudal "monarchy; the invention of fire-arms equal-"ized the villein and the noble on the field of "battle; printing opened the same resources "to the minds of all classes; the post was "established, so as to bring the same inform-"ation to the door of the poor man's cottage "and to the gate of the palace; the discovery "of America offered a thousand new paths to "fortune, and placed riches and power within "the reach of the adventurous and the ob-"scure."

Of all material things trade was the strongest in emancipating the people. Every new invention, luxury, and want made the workman of more value to society, while it kindled his ingenuities and raised him higher as a man. Mentally, the Reformation was the greatest quickener of the people of Europe to individuality and self-esteem. Every man found himself called on to think, to form a judgment, to take sides, and often to stake goods and life for his cause.

* J. S. Mill's Review of Michelet's History of France.

But what is the true elevation of the working classes? Stephenson, the founder of the railway, was a poor lad, earning twopence a-day at watching cows, because his father was too poor to send him to school; and at public meetings of mechanics and artisans he used to hold up this success of his as a stimulus to the workmen:—"Persevere as I have done, and you "will get on." Now, any youth growing independent of others, standing on his own feet, cutting out his own path, is always a fine spectacle. We confess to a thrill of delight at the sight of a poor lad, by unaided effort, rising to any real eminence, were it merely of wealth. But it is a poor, vulgar aim to hold up to working men, that of rising above their own class merely—at any price to better their livelihood. Yet this is the tone of some of our eminent teachers. We remember an address of Sir Bulwer Lytton's to the boys of one of our public schools, in this strain:—"I set out in life "determined to be something; aspire, and you "will rise." Lord Palmerston the other day addressed university students in the same spirit:—"Every department of labour is "crowded; you must struggle and fight to "win." All this may be very well; but the high-minded man asks, Persevere — aspire—fight—for what?

Now we would suggest that the end of life is not to grow rich, or learned, or famous—but to live. To live, first, bodily; not to be cooped up in a place and employment where your senses and limbs have no free play: above all to keep intellect, imagination, taste, affection alive; to put forth all your powers; to taste the whole round of existence; to be able to say at the end of every day, every year, aye, at the end of life itself—"I have lived." That we have remained in the same social class we were born in, have followed the same humble calling as our fathers, is a small matter; but that our intelligence has grown larger and larger; our manners and thoughts more and more beautiful and magnanimous; that our whole life is truthful, and brotherly, and lofty, rich in relationship and fellowship, enjoyment and influence—this is success—the true rising of the working man!

THE WRECK CHART.

WE have lying before us a remarkable map—the Wreck Chart of the British Isles for 1858. It is to be found in a return to Parliament, carefully prepared by the Board of Trade. The chart is of the same appearance as an ordinary map of these islands, except that the whole line of coast, from the Orkneys to the Land's End, is dotted with a series of black marks. Each mark indicates either a shipwreck or some casualty to a vessel nearly approaching that disaster. A most melancholy effect has this chart when this key to its object is given. The whole coast, particularly near the approaches to our great commercial cities, bristles with the dottings which indicate clearly the site where some noble ship has gone to destruction with her human freight. All round our coast, with the aid of this valuable map, we can trace clearly the frightful work of destruction during the past year. The total number of British merchant ships, including steamers, is supposed to be 27,097, giving a tonnage of 4,558,730. These ships are handled probably by no less than 300,000 men and boys.

The nature of the disasters to British and foreign ships is thus epitomized:—In 1858 the number of vessels wrecked on the coast and in the seas of the United Kingdom was 1,170; of these 354 were total wrecks, 50 sunk by collision, making the number totally lost 404. Vessels stranded and damaged so as to require to discharge cargo 515, by collision 251, total 766; making the whole number of wrecks 1170. By these disasters the lives of 1,865 persons were emperilled, of which number 340 persons or 18 of the whole were actually lost.

This is the dark side of the doleful map. It has, however, a bright side, and on that we find that by the life-boats of the National Life-boat Institution, those of local bodies, and various other craft, 1,555 of our fellow-creatures were, during the past year, rescued from a watery grave. The red dottings on this unique chart are cheering marks, as indicative of the places where life-boats and the life-preserving apparatus are to be found in the hour of distress. The latter are under the control of the Board of Trade, and as the firing of the apparatus requires some knowledge of gunnery, they are principally in the charge of the coast guard.

It is very gratifying to find that life-boats on dangerous points of the coast have, of late years, greatly increased in number and efficiency under the management of the National Life-boat Institution, whose energies in this good work are untiring. It has now eighty-two life-boat establishments under its management, and we only wish that we were able to report that it had twice that number, for there are still too many exposed points in need of these arks of mercy; and although shipwrecks will occur, notwithstanding all our precautions, yet if life-boats were more numerous on the coast, and if ship-owners paid more attention to the condition of their vessels and crews before they sent them to sea, much might unquestionably be done to lessen the melancholy disasters on the coast of the British Isles.

SMALL-ARMS FACTORY AT ENFIELD.

THERE are not many manufactories in the kingdom which are of more immediate importance to the public at this moment than those wherein heavy guns and small arms are manufactured and never, fortunately, was the rate of production greater in either case than now. At Woolwich gun foundries, with all the rapidity contingent upon increased facilities and more room, they are turning out the former; whilst at Enfield the smaller—but not less necessary implements of war—rifles, are completed with a speed almost incredible. Of Woolwich we have aforetime rendered an account to our patrons, the public, and it is now intended to give some information as to Enfield.

A few years back and it might have been advisable to have given, by way of preface, the geographical position, and means of getting to this place; but now all know its whereabouts, and such a course is quite unnecessary. The exterior of the small-arms factory at Enfield Lock is constructed after an elegant design, and cannot fail to create an agreeable effect on the mind of the visitor, be that mind scientifically trained or not. It is of considerable size, but unfortunately the interior of the edifice is not equal in beauty to the exterior—unfortunately, we say; but since the useful predominates *inside*, it may be admitted that that fact is a set-off against the merely ornamental character of the *outside*. The arrangement of machinery within the walls is simple. There, in one large square room, in which perhaps 700 hands, young and old, are engaged, are placed the machines for fabricating the furniture, stocking, locks, screw-sights, bayonets, &c., &c., for rifles. Some of these machines are of exceedingly ingenious construction, and they are all kept in excellent condition. The plant of machinery for the production of the stocks is of American origin, and the Messrs. Ames and Co., of Massachusetts, figure largely in the inventive way. Messrs. Greenwood and Botley, of our own town of Leeds, have, however, effected considerable improvements in point of detail, whilst, as stated recently, Messrs. Hayes, Hague, and Williams,

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foremen of the various departments at Enfield, have won not only "golden *opinions*," but more substantial rewards for valuable alterations and modifications suggested and made by themselves. To mention one of these as carried out to practical use by Mr. Hayes, we may adduce that pertaining to the "swivel," which is a link to connect the "main-spring" with the "tumbler" of the rifle. Swivels are made complete, thanks to this gentleman's skill, by machines, from bars of ⅛ in. steel; and all are so perfectly manufactured that they inevitably fit a test-receiving gauge. Of the "tumbler" and "bridle" machinery it would be difficult, without drawings, to give clear explanations. It comprises a simplification of the principle of the Rose engine, and does not require in working the attention of skilled workmen. Since the appliances produced by the tumbler and bridle machines are of a very minute and delicate description, it may be imagined that much patient ingenuity was exercised in perfecting them, and this is true. At the rate that the Enfield rifle, of the pattern 1853, is being made, these little improvements, moreover, are great enough in their consequences to save fully £2,000 per annum to the country.

From the large room, in which multifarious operations are going on with unflagging regularity, one passes forward to the Smithy; and here again machinery has been brought to bear with wondrous precision. Everything prepared in this department is touched more or less by machine power. From this commodious and convenient apartment doors open into all the following:—the tool-department, where all tools are made and repaired; the hardening-room, where all the bayonets, main-springs, scar-springs, and ramrods are tempered; the polishing-room; grindery; and various places of comparatively minor importance. A pair of 40-horse power engines, fitted with Fairbairn's expansive valve motion, drive the whole of the machines, whose "name is legion," in the above-named branch of the Rifle Factory. On the opposite side of a basin or mill-head stands another building, parallel with that mentioned above. This is of extensive dimensions, and two stories high; and here the barrels are manufactured. Combined steam and water power is used in giving motion to the machinery in the barrel department; and this consists of a 25-horse power condensing engine, with one 20 and one 25-horse breakwater wheel.

With regard to the prime cost of a finished Enfield rifle of the approved 1853 pattern, it may be said that it is about £2 5s. It is a most serviceable weapon; and, from the extreme accuracy with which its parts have been fitted, and the power of interchanging them, it has an advantage over all hand-made guns. A defective part can be replaced at once without fitting. When all the component parts have been carefully tested by viewers, or inspectors, especially kept for the purpose, and who have a thorough knowledge of their duties, it is next to impossible that there should be differences. In fact, so wondrously true are all the machine-prepared parts of the rifle to each other, that a workman will take up the requisite pieces indiscriminately from boxes full of them, and put a rifle together before your eyes in three minutes! From fifteen to eighteen hundred rifles per day of ten hours are at present being finished at Enfield Factory, and this gives (nearly) an average of one rifle completed from the material every two minutes, and made fit for shooting down an invader!

Altogether the number of persons employed amounts to somewhere near 1,500, and the offices and stores are admirably arranged. Colonel Dixon, of the Royal Artillery, a most persevering and exemplary gentleman, assisted by J. H. Burton, Esq., an American, and Chief Engineer, have the control of the entire establishment, which is conducted, so far as we can judge, in a most efficient manner.

Looking at the state of affairs across the Channel, Government and people here may well look also towards Enfield.

MAJOR RHODES' PATENT TENTS.

IN our last volume we published an elaborate description of Major Rhodes' improved tents for army and other purposes, and expressed our high sense of their value. These tents having recently been brought under the notice of the authorities at the Horse Guards, the Duke of Cambridge gave directions for two of the tents to be pitched at Chatham garrison, in order to put to a practical test the superiority of the invention over the ordinary military tents now in use by the army when encamped at Aldershot, the Curragh, Chatham, and other military stations. Two of the tents have accordingly just been erected on the grounds adjoining the Garrison Hospital at Chatham, under the personal superintendence of Major Rhodes. "During the storm and hurricane which swept over Chatham on Wednesday night," says the *Times* Chatham correspondent, "they were found to be in every respect superior to the ordinary tents erected near the same spot. . . . . After the tent had been fixed on Wednesday afternoon, ten of the portable bedsteads from the hospital were moved into it, and as many patients directed to take possession of them. Notwithstanding the tremendous storm which raged early yesterday morning, not the slightest inconvenience was experienced by the inmates, who slept as dry as in an ordinary room, while many of the other tents admitted the water, which poured in as through a sieve. Major Rhodes' hospital tent can be pitched by eight men in 12 minutes; and, whereas in the present tents there are about 150 pegs and 70 ropes to each, the new invention has only about 40 pegs and 12 ropes to secure it, there being no necessity for the men to turn out in the rain during the night to 'slack' the ropes as with the present tents—a serious matter when that duty has to be performed by sick patients."

The advantages of Major Rhodes' tents over those of the Government may be briefly noticed. His hospital tent weighs about 112 lbs. less than the Government hospital-marquee, and its cost is about £3 under the Government contract price. The ventilation is most efficient, and subject to the control of the medical officer—impervious to wet, and the strong rays of the sun—can be pitched in 12 minutes by 8 men. The Hanoverian Government (who have practically tested this tent) pronounce that Rhodes' hospital tent affords the best shelter hitherto obtained in camp hospitals, &c. The price of a Government hospital marquee, 30 feet wide by 14½ feet, and 14 feet in height, is from £33 to £35, and weighs (in three packages) from 507 lbs. to 652 lbs. (the latter weight includes 4 ground sheets.) It affords accommodation for from 18 to 20 patients. Major Rhodes', 20-feet diameter, field-tent cost £24, viz. about £12 cheaper, and weighs (in 2 packages) 230 lbs., viz. 277 lbs. less than the Government hospital marquee. It offers accommodation for from 18 to 20 patients. Two of Major Rhodes', 20-feet diameter, field tents can be pitched by 4 men (in about 8 minutes for each tent), on about the same space of ground as is requisite for only one Government hospital-marquee: and further, from 10 to 14 men require from 15 to 20 minutes to pitch the latter tent. Major Rhodes' tent provides detached accommodation for 24 rifles, 24 sets of accoutrements, and 24 knapsacks, with a perfect system of ventilation; in which very important points the Government hospital marquee is deficient. Irrespective of cost, &c., it results that by adopting Major Rhodes' tents into the service, healthy shelter can be provided for about 45 men, allowing the same amount of transport as is at present necessary for conveying only one Government hospital marquee, which latter only affords accommodation for 20 men; thus showing a clear saving of more than one hundred per cent. in cost of transport, which, with an army in the field, would be a very great relief to the Commissariat Department.

We now learn that the officers appointed to examine Major Rhodes' tents at Chatham are about to report most strongly in their favour to the Commander-in-Chief.

BREAKWATER AT THE PORT OF BLYTH.

BY MICHAEL SCOTT, C.E.

THE following article is abridged, and the accompanying engravings are reduced, from the official proceedings of the Institution of Civil Engineers:—

The Port of Blyth is situated on the coast of Northumberland, about ten miles north of the river Tyne. It need hardly be stated that the whole surrounding district is rich in coal, there being a large virgin field of steam-coal in the immediate vicinity of Blyth. Until recently only a small class of vessels could trade to that port, and a great part of the coal raised in the neighbourhood was transmitted by rail to the Tyne for shipment. But a few years ago a company of enterprising gentlemen, headed by the lord of the manor, Sir M. W. Ridley, associated themselves, and obtained powers for improving the harbour. Mr. James Abernethy, M. Inst. C.E., was engaged as engineer-in-chief, and under his direction the works were commenced. Certain reasons, with which the author need not trouble the Institution, induced him to undertake the construction of a portion of these works; and merely observing, that the present communication has reference exclusively to the breakwater, he will proceed to describe it in detail.

It is well known that there is a very heavy sea on this part of the coast; and that this must be the case will be obvious, when the great reach of water east and north is taken into consideration, the nearest land being the coasts of Norway and Denmark, which are distant from 400 miles to 500 miles. But it is not so commonly understood that gales spring up with a suddenness which increases the peril to men, and the risk of injury to works in progress. It is necessary to note this peculiarity, because it increased the difficulty of carrying out the work as originally designed. For a length of a mile the river was exposed to the action of the sea, and it followed that no vessel could then lie in this portion of, what is now, the harbour. Along the seaward side of the river there is a rocky reef, and upon the base thus provided by nature the breakwater has been erected. The work was originally intended to be, and for a length of 1,800 feet was constructed, entirely of stone; but a failure in the supply of material led to a change, which has resulted in the work shown by Figs. 1 and 2. Mr. Abernethy proposed to employ timber and stone, after the manner adopted at Boulogne and Calais, and furnished a design similar in outline to Fig. 1. As the contractor for the work, being aware of the impossibility of obtaining, on the site, stone suitable for facing, and seeing that during very high tides there was great risk of damage to the open end, which had already been injured several times, the author gladly undertook to do all in his power to carry out Mr. Abernethy's views; and after a good deal of consideration, the forms shown in Figs. 1 and 2 were arranged, and were erected with entire success some time ago. It will be observed that those portions of the breakwater which are illustrated by Figs. 1 and 2, consist of a framework of timber, filled with stone, and arranged as follows:—First, there is a sole piece resting on the ground. Upon this sole are raised two uprights, the one next the sea being supported by a strut from the sole piece. Cross-bearers, or half-balks, embracing the uprights, carry the roadway above; and this is protected by a simple handrail. The frames thus formed are placed at intervals of 10 feet from centre to centre, and are tied together, longitudinally, by walings, two on the sea face, and one on the river face, and also by the open planking, the space contained within which is filled with rubble-stone. It will be seen that, in the first section, Fig. 1, this space is triangular, the planking on the river face being on the strut. The object of this arrangement was, partly to provide a sloping surface, and to leave the river-uprights isolated, opposite the entrance of the proposed docks, for the purpose of destroying, as much as possible, the swell which

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passes up the river. In the second section, Fig. 2, the exposure, and consequent strength required, being greater, the planking was put upon the river upright, and the whole space was filled with rubble, and was covered with an open flooring of horizontal timbers. The work has added more than 4,000 feet, in length of the river, to the harbour, where there is still-water; and not only effectually breaks the waves, but it acts as a training wall, to direct the current, and to confine, and to intensify within the new limits, the action of the tidal scour. During its erection there was no risk of injury, and no part of the timber-work has been breached, although the weakest portion has been exposed, for more than two years, to as heavy seas as were ever seen on that coast. The cost of the work has been, on an average, about £10 per lineal foot. The timber has all been creosoted, and bids fair to resist decay for many years.

In the case of the portions of the pier just referred to, the site was either dry, or nearly so, at low-water spring tides; but the line upon which it was to be continued led into a depth of 5 feet, or 6 feet at the lowest ebbs, and about 22 feet at high-water spring tides. From this arose the necessity for a change of plan; but in arranging the breakwater, so far as hitherto described, the author's attention had naturally been turned to the question generally; and Mr. Abernethy having suggested that he should attempt the application of timber to deep-water sections, the author considered the subject, and, as early as January, 1857, succeeded in attaining that object, having then designed deep-water sections very similar to those to be described.

* * * *

This section of the paper will be occupied with a description of the author's improvements in the construction of breakwaters, examples of which are represented in Figs. 3 to 9.

The author divides these works into two classes; those intended for deep water being wave reflectors, and those for shallow water wave breakers. Excepting the wave screen, the reflectors and breakwaters are of a similar character, and consist of a timber casing filled with stone. The stone hearting constitutes the power to resist removal as a whole, and the timber facing secures the stone from being disintegrated, or carried away in detail; so that if the work is moved it must be bodily. Further, the work is so connected together, that each part supports its neighbouring portions: the importance of this will be obvious when it is considered that waves seldom strike any great extent of surface at the same moment. A marked peculiarity of the arrangement is, that there is no tie between the work and the ground. It simply rests on the surface, and the stability depends wholly upon its weight. The author is opposed to the idea of piling the face, and filling in behind with stone, not only because it is difficult and expensive to pile in a sea-way, but because, in his estimation, it is false in principle. For the piles would necessarily bend before they took any appreciable part of the strain, and before they could deflect, the stone backing must have been moved. Piles may, however, be used in some cases, as a convenient method of filling the space between the frames, for the purpose of keeping the stone from spreading; but then, on the author's plan, these piles would be driven subsequently to the erection of the frames, which constitute an efficient staging from which to drive them.

Other leading features are—the framework is so arranged, first, that the strains are, as much as possible, taken in the direction of the length of the timbers, thus developing its greatest strength; secondly, the joints are covered by whole timbers; thirdly, each piece is proportioned to the work it has to do; and lastly, there is such a variety of size, as to admit of average cargoes being wholly worked up without waste. The faces are so tied inwards as to prevent the rubble from being forced out; and whilst the interstices are sufficient for the free escape of air, there is, after a short time, no motion amongst the stones, and consequently no waste. It will be seen that an excellent foundation is secured as the work proceeds; and the lower tie will accommodate itself so perfectly to an uneven surface, that the erection may proceed on sand and on clay, as well as on rock; on broken, as well as on even ground, almost indifferently. A proof that the foundation is sufficient has been afforded by the work at Blyth, where, although the bottom varies from hard rock to soft clay, there is no observable settlement in a length of more than 2,000 feet. The difficulty of obtaining timber of the requisite length, combined with the certainty that single balks would be fractured, on uneven ground, by the superincumbent stone, led to the designing of the chain tie, which has just been referred to.

The round ends, at the entrances to harbours, are proposed to be constructed of planking, arranged like basket-work, by which great strength is obtained.* Moreover, there is considerable elasticity, so that in the event of a ship touching, neither the pier nor the vessel is damaged. When these ends are of comparatively small diameter, as the one now constructing at Blyth, they are tied into the centre; but when large, the frames vary in breadth according to the exposure; that is to say, the face wall, as it may be termed, increases in thickness from the inner or harbour face seaward.

FACILITY OF CONSTRUCTION.

Before entering upon details under this head, the author claims for his improved arrangements one important advantage, viz., that the work is not liable to be breached during erection. Those only who have had to contend with the sea can appreciate this risk; for although every precaution may be taken, still, in the case of vertical walls, of the ordinary kind at least, there is great danger during erection. The stone wall at Blyth, for example, was repeatedly damaged, but no part of the new construction has ever been breached, although exposed to a heavier sea; but, even in instances in which the permanent work has not been much injured, the staging has suffered; whilst at Blyth, the work itself serving for a staging, no loss has arisen from this cause. It is not only loss of money which is avoided, but loss of time; for there is much less risk of the work being interrupted by bad weather.

In the arrangement proposed, no stone of a high class is required, and no dressing. With respect to the timber, it is easily procurable at any port, and it is all converted on shore, the frames being put together complete, and then floated to their place. It might be thought that, in very deep water, the frames would be difficult to manage; but the experience of the author leads him to a contrary opinion, and he would not hesitate to undertake the erection, even in comparatively great depths. With reference to this point it should be remembered that the addition of 9 lbs. or 10 lbs. of creosote per cubic foot materially reduces the floating power of the timber, so that the following is a statement of the buoyancy of a 10-fathom section (Fig. 6). Supposing the whole timber immersed, the total buoyancy would only be 15 cwt. per foot run of the breakwater; but as the timber is not wholly immersed, there is no buoyancy. At half-tide, when standing on end, each frame would have a weight, or downward pressure, equal to 8 cwt. to sink it. The timber-work, when finished, will have a downward pressure of 25 cwt. per foot run. Thus, it appears, that the weight to be lifted is but little, and that the frame, in position, can easily be made to gravitate sufficiently to steady itself until secured.

In the direction of the length of the breakwater the frames are kept parallel by the sliding ties, which are simply balks of timber with chocks between them embracing two frames, and being secured together above water, they are slid down to the bottom. To obviate the employment of divers, the spaces between the frames, under low-water mark, are either filled with panels lowered from above, or by vertical pieces secured by the sliding-ties, or by piling. These piles may be driven, or screwed, the sliding-tie forming a guide for the foot of each pile. In driving piles the author has placed the shoe on the corners of the piles which are exposed to the greatest pressure, and are most liable to abrasion. If screws are adopted, the author has designed an arrangement which, he thinks, would cost less than Mitchell's screws, and which is as follows:—The angles of the wood being removed, a thin T iron is heated, and wound spirally round the lower end, and this being cooled, shrinks and grasps the wood, like the tire of a wheel. The advantage of this plan is its cheapness, and the strain, instead of being concentrated, as in Mitchell's piles, upon the short piece of the pile embraced by the iron socket, is distributed over a considerable length of the balk.

It would be tedious to go further into detail upon such points. It may suffice to say, that no system of piling can be compared with the plan of first sinking frames, for cheapness and speed of execution, and in hard ground piles are inadmissible. The progress at Dover is said to be 100 feet per annum; and, as the breakwaters at Alderney, Portland, and Holyhead have each been about ten years in hand, the systems pursued at those places do not appear to secure rapid execution. In this particular it is thought a saving would be effected by the new arrangements; and as an illustration of what can be done, although of course on a comparatively small scale, it may be mentioned that of the Blyth work 130 lineal feet have been erected in five days.

POWER OF THE WORK TO RESIST WAVES.

It has been said that the timber-faced work cannot be breached and broken up in detail, that it must go as a whole—in fact, be overturned bodily; and it is now necessary to ascertain what amount of force would effect its destruction, which, unlike the case of most stone piers, is readily calculated. In the section designed for deep water, the power of the sea to overturn the work would be represented by the statical pressure of the water rising against the parapet, and the power of resistance in the work by the weight of the stone, less its displacement—the timber having no buoyancy. Proceeding upon this principle, and taking the 10 fathom section (Fig. 6) as an example, it is found that the stability is double the greatest force which could be brought to bear upon it.

It has been stated that waves travelling into shallow water must break, and in situations where it is necessary to provide a protection under these circumstances, a wave-screen, such as is represented in Figs. 8 and 9, is to be preferred. It will be observed that the screen consists mainly of a grating of timber, supported on piles, and inclined towards the sea, so that the waves will run up and the water will drop through the transverse openings, both on its ascent and descent, and little if any will return to the foot. In the case of a stone slope, the whole of the water which has been projected up the slope runs back, and it is by this recoil that the great damage is done. The dropping through of the water has another important advantage. Suppose the oscillation of the water passing under the toe of the screen to be only partially destroyed, the remaining motion cannot be more effectually combated than by the vertical and continued fall of water through the screen. Moreover, the effect of the blow of the waves upon the slope is diminished by the openings between the planks. There is, however, a limit to increasing these spaces, for if they are too wide the water falling through, instead of neutralising the existing oscillation would produce a fresh one. The longer the slope the greater the surface over which the force of a given wave is distributed, and the less the horizontal strain produced; but if the slopes were too flat, the effect would be that the wave would run up and fall over.

This wave-screen has a peculiarity which, in many situations, is of the greatest importance, —namely, the allowing the tide or currents of the sea to pass through with little interruption,

* A model of this arrangement was exhibited at the meeting.

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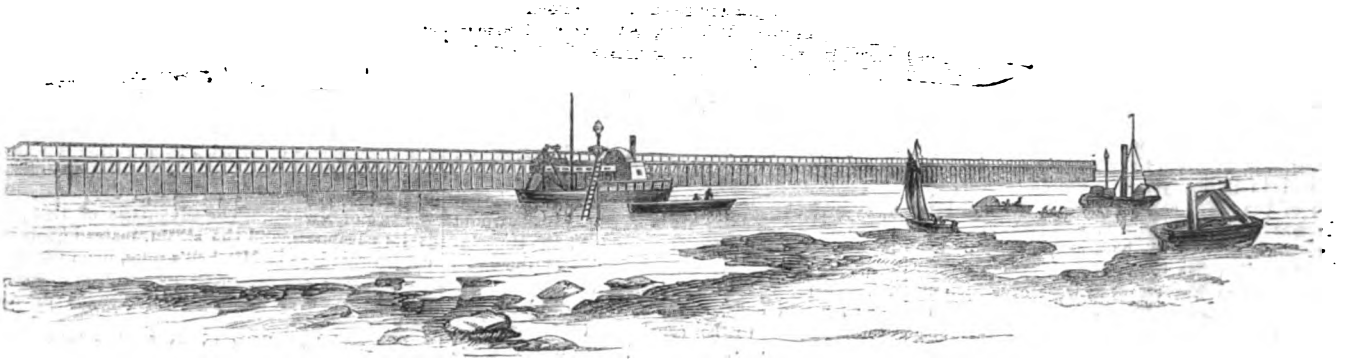
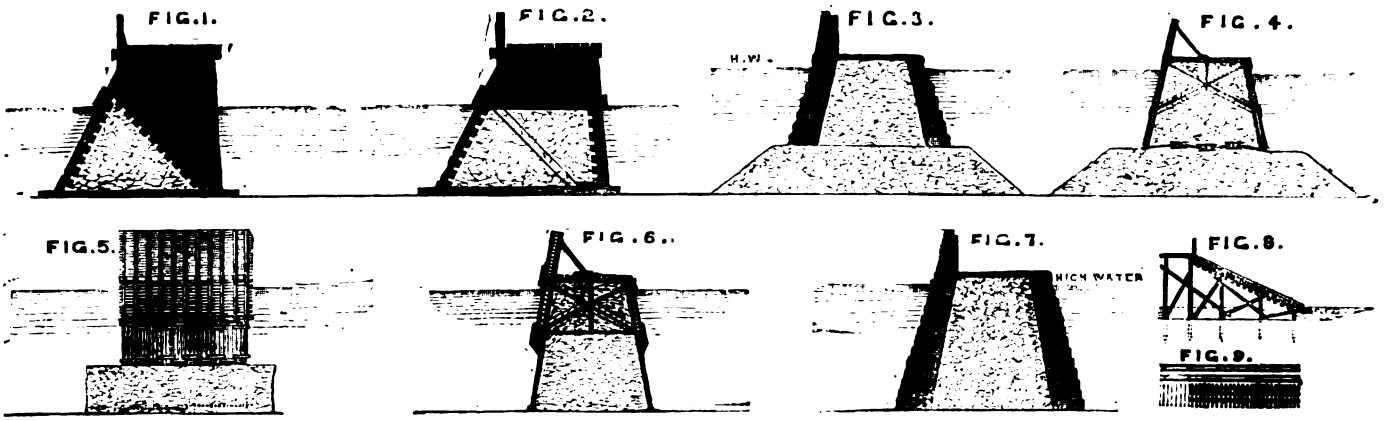
BREAKWATER AT THE PORT OF BLYTH.





thereby preventing the silting-up of a bay, or the estuary of a river, which is a general consequence of its enclosure by any breakwater of an ordinary kind.

The construction of the screen is of the simplest kind. It consists of piles at considerable intervals. To these the main timbers are secured, upon which the grating of planks is laid. It will be observed that these planks are tapered in cross section, making the lower edge thinner than the upper edge. The object of this is threefold. First, it diminishes the shock of the water on the planks as it rises; secondly, it ensures the interception of the water on its descent; and thirdly, it gives to the main timbers a secure hold of every plank.

DURABILITY AND COST.

These two stand in such intimate relation to each other, that it is proposed to consider them together. The first question which arises is, how long will the timbers last? To this it is not easy to give a definite reply. The chief enemies to be encountered are the Teredo Navalis, or great worm, and the Limnoria Terebrans, or surface worm, as it is often called, but which, in fact, is a species of shrimp. The operations of the Teredo are said to be confined to the space between low-water and the bottom, as they cannot exist out of water, whilst the Limnoria attacks the wood chiefly near low-water, and particularly at the surface of the ground, in cases where the bottom is dry at low tide. There is no doubt that unprepared fir-timber, excepting the more resinous pines, would in some cases be destroyed in a few years by these animals, and it is said that even greenheart succumbs in time to their efforts; but there are instances which indicate great durability. The piers at Boulogne and at Calais may be mentioned as having stood for many years—a part of the latter, which is of oak, being above seventy years old. But the true question is with regard to the durability, not of raw, but of prepared timber; and the experience of the author of the process of creosoting leads to the belief that, when properly done, it will preserve timber for many years, though how long it is impossible to say, as time alone can show.

There is another material which the author is at present testing, but a sufficient period has not elapsed to prove its qualities. The author is of opinion, that there can be little doubt that the timber would last twenty years; but, without speculating further upon this point, it will be sufficient to show, that the difference in first cost between ordinary stone breakwaters and the new arrangement, is so great as to leave an ample margin in favour of the timber system. The 10-fathom section, Fig. 6, would cost, complete, about £70 per lineal foot; whereas the stone breakwater at Alderney is said to have cost £190 per foot, and that at Portland £150 per foot. The cost of these, as compared with the timber system, for a length of say 2,000 yards,—about the length of Portland and Holyhead,—would stand as follows:—

Timber System, Fig. 6	£420,000
Portland	900,000
Holyhead, unknown, but believed to have cost a great deal more.	
Alderney	1,140,000

The manner in which the timber of such a work, as is shown in Fig. 6, would be renewed, would depend on the nature of the bottom. If it was clay, or sand, for instance, the face might be simply close piled, and by the application of the new arrangements for piling, this would not be an expensive operation. But if the bottom were hard, than a cradle filled with stone might be lowered and thus the face would be renewed. This cage, as it may be called, would have several hundred tons of stone in it, and this would represent the weight of the smallest pieces of the face.

Finally, it remains to be shown, that even if the new arrangements be regarded merely as a means for forming the back-bone, as it were, of a more permanent stone structure, it is the best and cheapest way of attaining that object; for, viewing the timber only in the light of a temporary staging, the following would be some of the advantages of the system—rapidity of execution; the enclosure of the harbour, and the protection to the shipping being completed years before an ordinary stone-work could be erected; and an excellent staging from which to build the stone facing, which might be proceeding at several places at once, as there would be no interference from the current, and no danger of breaching. Then the rubble hearting, having been exposed to the sea for years, would be thoroughly consolidated, and would form an impenetrable backing, which is always of great importance, and from the strength of the staging very large blocks might be employed in the facing.

(To be continued.)

FRENCH PRIZES FOR REAPING MACHINES.

PARIS, Friday July 23.—The competition for the prize proclaimed for the best reaping machine came off yesterday at Fouilleuse. The Emperor was present, and exhibited the greatest interest in the proceedings. Forty-five machines had been registered, but twenty-five only appeared in the field. A wide extent of harvest land had been divided in patches of wheat, rye, and barley—all nearly in equal proportion. The cutting of each patch was drawn for by lot. The machines were catalogued under two distinct heads—the foreign machines and those of French manufacture. The prizes for each division were the same—1,000 fr. and a gold medal first prize, 500 fr. and a silver medal the second, 300 fr. and a bronze medal the third. Moreover, a great gold medal had been voted as honorary prize to the machine considered the best of the whole, whether French or foreign. This prize, as well as the first in the foreign division, fell to the lot of Messrs. Burgess and Key. Worked by two horses, its action surprised the assembly. The harvest fell before it with a precision and regularity never attained by human hand, while the quickness with which the work was executed proved an incontestable superiority over manual labour. Moreover, this machine proved itself the only one in the field capable of being worked with the assistance of only one man, and by measurement it was known that the Burgess and Key reaper could clear an hectare of ground in an hour and a half. Cranston, of London, obtained the second foreign prize. The first French prize was awarded to M. Mazle, of the Department of the Orne, the second to M.

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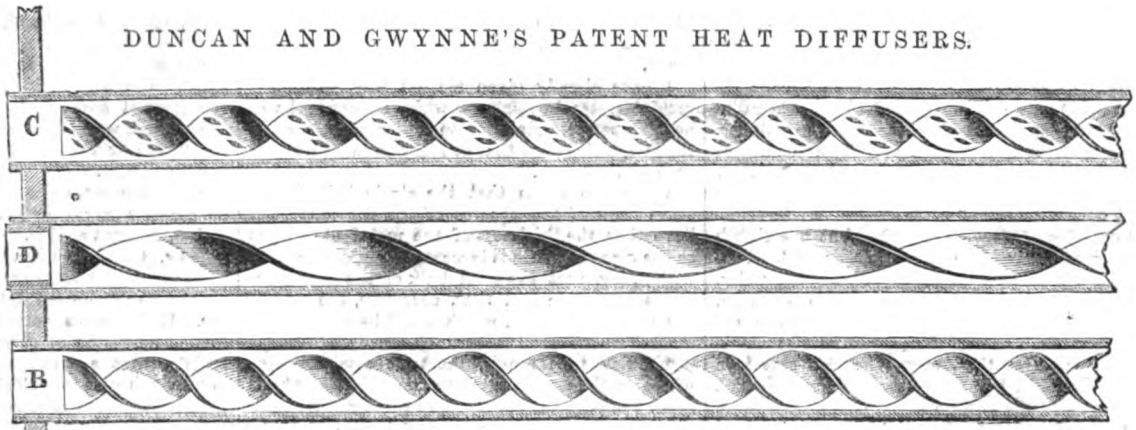
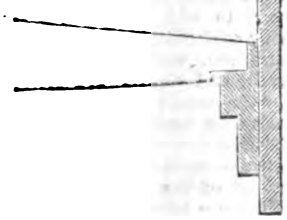
DUNCAN AND GWYNNE'S PATENT HEAT DIFFUSERS.



Longitudinal section of part of a tubular boiler, with three varieties of spiral heat diffusers, shown within the tubes, the central tube has a ferrule inserted.

C represents the spiral with holes cut through the plate, which is of some advantage with a short pitch spiral.
D represents a spiral with a long pitch, most suitable where the fuel is bituminous, or the draught sluggish as in marine engines.
B represents a short pitch spiral for boilers where the draught is strong, or the fuel coke as in locomotives.



AN invention has recently been introduced whereby the steam-producing power of engines may be greatly increased. This is done by introducing into the tubes of boilers spiral heat-diffusers. By the aid of these diffusers a column of heated gas is so distributed in the tube of the boiler as to make it produce, it is said, about 30 per cent. more steam. Flames and other gaseous products of combustion in passing through the tubes of boilers now in use, impart only a portion of their heat to the surrounding metal. These productions pass with considerable rapidity through the tubes, and being æriform and bad conductors, consequently a large proportion of their energy is unproductively expended by the present mode of generating steam. The metal of the tube only absorbs heat from that portion of the column of flame in direct contact with it, consequently, the central portions of the column are permitted to escape with the smoke out of the chimney. The patent heat-diffusers now under notice break up this column, and compel its component particles to strike against all sides of the tube. In this way more heat is transmitted to the water of the boiler, and consequently more steam produced at a less cost.

The advantages of these heat-diffusers are obvious and manifold. In the first place they are very simple, and their application does not require any alteration of the boilers now in use; and they can be inserted at the shortest notice at a comparatively small cost. Secondly, it has been proved by experiment that they are self-cleansing. Thirdly, they materially lessen the consumption of fuel. This is their characteristic advantage, and will in all probability recommend them to the consideration of engineers, railway and other companies.

Upon the 9,500 miles of British railway there are now employed more than 5,000 locomotives, performing an annual mileage of upwards of 90,000,000 miles. The fuel consumed by these engines may be taken as equal to 1,500,000 tons of coke; and this quantity of fuel may be valued at £1,200,000. The introduction of the heat-diffusers to the above number of locomotive boilers would effect, at 30 per cent., an annual saving of £400,000, and involve no alteration in any of the existing arrangements.

No doubt this invention will be found particularly valuable to steam navigation. A full-powered 3,000 tons paddle steamer carries 550 tons of engines, boilers, and appurtenances, 1,400 tons of coal, and 100 tons of water in her boilers, making nearly two-thirds of her burden. It is principally on account of this vast tonnage of fuel that steam navigation has hitherto proved a commercial failure—as it is well known that no line of swift steamers can exist without a Government mail contract. If, however, a steamer which has hitherto required 1,400 tons of coal may, by the aid of the heat-diffusers, perform her voyage with less than 1,000 tons, a vast saving will be realised. Supposing the coals to cost £1 per ton, there would not only be the saving of £466, but there would be 466 tons of freight space, amounting, on a rough calculation, to £1,350, at the rate of one farthing a ton per mile, being £1,700 upon a single voyage to New York, or £3,400 on a voyage there and back, which is more than equal to the Government subsidy now granted to each large mail steamer.

We may add that the patent heat-diffusers are manufactured and supplied by Gwynne and Co., Essex Wharves, Strand.

WARD'S AMERICAN SHIP SIGNALS.

Mr. W. H. Ward, of Auburn, United States of America, yesterday exhibited in Woolwich Dockyard, by permission of the Lords of the Admiralty, his patent invention for transmitting messages and carrying on correspondence of any length from ship to ship, becalmed, or sailing within telescopic sight of each other on the ocean, with equal facility to that of the electric telegraph on land. The exhibition was witnessed by Commodore the Hon. James R. Drummond, C.B., Aide-de-Camp to the Queen, in his official capacity as superintendent, attended by the entire body of officers representing the various departments of the yard. One of the instruments was erected at either end of a long enclosed lobby adjoining the dockyard factory, when a lengthened test of messages and replies was satisfactorily carried out. The experiment was extremely interesting and conclusive as to the merits of the apparatus, the result of which was promptly transmitted to Lord Clarence Paget by special direction of the Commodore to that effect, the invention having been pronounced one of the most important of the kind hitherto produced, and likely to be productive of immense benefit to the entire naval and merchant service afloat. The weight of the instrument, which is of the simplest construction, does not appear to exceed 14lb. It represents the form of a cross, exhibiting five alphabetically marked lamps, which are worked by a process resembling the keys or notes of a piano slowly depressed, and at the termination of each sentence the lights are clouded. As regards the working of the instrument, the principal officers of the Fisgard who yesterday attended the experiments affirmed without hesitation that any boy of Her Majesty's fleet could obtain a prefect mastery of the system by a couple of evenings' study.—*Naval Intelligence of the "Times."*

Lallier, of the Aisne, and the third to M. Legendre, of the Charente Inferieure. Independently of these testimonies to physical perseverance, another prize of more importance still was voted to M. Durand, Mayor of Baruel, for the moral perseverance with which, in spite of the opposition of ignorance, he had encouraged the use of the machine in his commune, and a silver medal and a sum of 100f. were likewise awarded to the ploughman in the employ of M. Durand, for having aided his master in this undertaking. The Emperor was accompanied on the ground by the Count de Montebello, where he was received by M. Rouher, Minister of Agriculture, by Count Chasseloup-Laubat, Minister of Algeria and the Colonies, and by all the notabilities connected with the progress of agriculture in France. At the close of the experiments the Emperor presented to each of the successful candidates the prize which had been awarded him, and at six o'clock left the field amid the hearty plaudits of the assembly.—*Correspondent of "Morning Star."*

THE MANUFACTURE OF CANNON.

(*Concluded from p. 58.*)

MR. LONGRIDGE next made a gun of a thin cast-iron tube, with wire coiled round it. It weighed only 3 cwt., yet threw a 9-pound shot 1,500 yards.

A 6-inch hydraulic press, which he had made of cast-iron three-quarters of an inch thick, with wire coiled round it with a carefully-calculated increasing strain to a thickness of half an inch, was sent to a gentleman at Glasgow to be tested; he reports that it has borne a pressure of upwards of seventeen tons per inch! One-fourth of this would have destroyed most cast-iron cylinders of treble the thickness.

Time, I regret, will not permit me to describe any other of Mr. Longridge's valuable experiments. I will only mention one more experiment to-day, but that a most important one, because made by Colonel Treuille de Beaulieu, a distinguished French artillery officer, and one of the *Comité d'Artillerie* of France. He had a 32-pounder (French 30-pounder) turned down cylindrical from the breech to near the trunnions. Over this he shrunk steel tubes, accurately bored.

At first sight this looks very like my plan, but I regret to say that I cannot quite agree with Colonel Treuille in his method of construction.

The steel he uses is very tough, and similar to that wonderful metal now made so inexpensively

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by the Mersey Steel Company. Like it, it can be stretched one-fifteenth of its length without breaking, and one one-hundredth-and-fiftieth without losing its elasticity. Colonel Treuille made his outer tubes only one three-hundredth of their diameter less than the outside of the cast-iron cylinder. This was about 16½ English inches in diameter; the bore of the gun being about 6½ inches. Now this cast-iron cylinder is thicker in proportion to its bore than any of those Major Wade tried. The outsides of his were stretched but one-eighth as much as the inside, *when free to expand.* I do not think that in Colonel Treuille's 32-pounder, therefore, the outside of the cast-iron cylinder, encompassed by a strong steel envelope, can expand more than one-tenth as much as the inside of the gun. Granting, even, that his cast iron can be stretched 1 in 300 without danger (which I doubt), still the outside would only be increased, even then, 1 in 3,000. One three-hundreth added to one three-thousandth would then be the greatest elongation of the steel possible, without fracturing the inside of the cast iron. Nearly one-half of the strength of the steel is thus made no use of.

As it is, the gun is strong enough to resist any strain by gunpowder in a lateral direction. When Colonel Treuille first showed and explained it to me, I ventured to express an opinion that the breech would eventually be blown back, owing to the great squareness of the end of the bore in French guns. I had the honour of seeing that gentleman, however, a fortnight ago, and was rejoiced to find, as I am sure you will all be glad to hear, that hitherto neither this nor any other catastrophe has occurred. On the contrary, the gun has borne 1,000 proof-charges without the slighest injury except to the vent, which, of course, has been more than once renewed.

Although I think that Colonel Treuille could have obtained equal strength by the use of one-half the quantity of steel, had he made the steel cylinders one four-hundredth part less in diameter, still, as he actually does not make them do ten times as much work as if they were not in a constant state of tension, I hope I may fairly consider him as an authority, and a most weighty one, in favour of the principle of construction I am advocating.

His method of manufacture must not be confounded with that proposed years ago by General Thierry, who thought to obtain the rigidity of cast iron and the strength of wrought iron by simply placing tubes of the latter metal over one of the former metal. Guns were so made, which looked exactly like Colonel Treuille's or mine; yet they were perfect failures. The reason is obvious; the strain was not communicated to the wrought iron, as it had no initial tension, or at most only enough to give it a firm hold on the interior.

The difference of opinion between Colonel Treuille and myself is only as to the degree of disproportion between the useful effect of the inside and the outside of cylinders. He thinks that in the 32-pounder he made, the outside of the cast-iron part, which was about 50 inches in circumference, could exert two-fifths as much strength as the inside, which was about 20 inches in circumference; the diminution being in the direct proportion of the diameter. Now, I believe that the diminution is in a greater ratio than even the squares of the diameters; in the above case more than 25 to 4, instead of 5 to 2.

The question is of such importance in deciding the *necessity* of abandoning the present method of making guns by casting, that I trust you will permit me to discuss it a little fully.

Those who, like Colonel Treuille, argue that the strain is in the inverse ratio of the diameter, must believe that the thickness of metal remains constant whatever the pressure; for under no other conditions would one part be exactly as much elongated as another. Even on this view of the case the outside of a service-gun, which is fully three times greater in circumference than the inside, could only do one-third as much work, because an elongation which would strain a fibre of one length to a certain amount, could only strain a fibre three times as long one-third as much.

I have already given reasons why the metal must decrease in thickness when strained; I will now, therefore, only refer to Major Wade's experiments, which show that in every instance he tried such was the case.

Those who argue that the strain is in the inverse ratio of the squares of the diameters, believe that the thickness of the metal diminishes as the circumference is increased by pressure from within, but that the total bulk of the metal remains constant; and that, therefore, the area of the surface of metal, which would be exposed by making a cross-section through the cylinder, perpendicular to its axis, must be also constant whatever the pressure. Now, on this hypothesis even, the outside of a cast gun could not do more than one-ninth of its work; *yet, in all Major Wade's experiments, the cross-section was decreased by strain* up to a certain point, which proves that the *useful effect of the metal must have decreased in a greater proportion than even the squares of the distance from the centre.*

Had I not found an account of these experiments I should have despaired of ever convincing any but persons possessing a knowledge of science that guns are at the present time being cast by thousands in such a manner that fully two-thirds of the metal in them is not only utterly useless but most mischievous, because rendering their transport more difficult and expensive; *and that the extreme outsides of the present guns cannot exert one-twelfth of the power they could be made to exert.*

These experiments are valuable to me also as establishing the truth of another argument I used here on a former occasion. It is constantly asserted that the pressure of the gas of gunpowder amounts to ten or twelve tons per square inch of surface, and that its action being sudden is more mischievous than an equal pressure applied more slowly. As guns do bear the repeated application of this pressure, I was told that I must exaggerate their weakness. My reply was, that the shot, by moving directly the first particles of powder burnt, leaves room for the rest to expand gradually, and that the pressure can never be so great as is said, because such pressure acting through a certain space must necessarily produce a greater velocity than we know is produced. The belief in the great pressure of the products of powder, which has been handed down to us from former generations, must now at last yield to demonstration. Major Wade burst a serviceable 18-pounder gun behind the trunnions with a pressure of 4½ tons per inch. The pressure of the gunpowder must therefore have been less than 4½ tons per inch, or at all events less destructive than that pressure longer applied. This is very important, upsetting all preconceived ideas of the violence of the explosion of gunpowder in the cannon now used. In larger guns the pressure of course would be greater, because the shot would acquire motion more slowly, therefore would leave less room for the igniting powder. Hence the larger the gun the greater the difficulty of getting it to resist the explosion; hence the utter impossibility of making guns beyond a certain size to fire full charges of powder without making more than one layer of metal take its fair share of work.

In rifled cannon this limit is reached in a smaller calibre than in smooth bores, because the resistance of the twist and of the friction prevents the shot moving from its place rapidly enough to leave room for the gas of the powder, which being thus confined exerts more power.* This additional power has been turned to advantage by Mr. Armstrong, but has hitherto baffled Mr. Whitworth, in his endeavours to obtain good results from rifled cannon. The 32-pounder and the 68-pounder made by the latter were burst by the pressure in the gun, though the shot was of iron only, and not tightly fitting. Mr. Armstrong's guns, on the other hand, bear without injury the much greater pressure resulting from the use of a bullet covered with lead, and fitting extremely tight. His bullets, indeed, are made larger than the general bore of the gun, are inserted at the breech end, where the barrel is slightly wider, and are forced by the gas of the powder through the narrower part. The pressure of this gas must be enormous, because the powder must have time to be entirely burnt before the shot moves many inches, resisted as it is.

How, then, does Mr. Armstrong obtain power, accuracy, great velocity, and extreme range from a pressure much greater than that which destroys Mr. Whitworth's guns? How can he use a pressure capable of giving such velocity to his bullets, that a twist not half so rapid as Mr. Whitworth uses is yet sufficient to ensure accuracy which must be seen to be credited?

I will answer these questions by quoting the words in which Captain Younghusband, R.A., described the manufacture of Mr. Armstrong's guns to the Royal Artillery Institution in April, 1856:—

"A core, or internal lining for the gun, was formed of cast steel, to which the requisite strength was given by encircling it with twisted cylinders of wrought iron, made in a similar manner to gun barrels, and tightly contracted upon the steel core by the usual process of cooling after previous expansion by heat; *the parts are then in that state of initial tension which is necessary to bring their entire strength into operation.*"

This "initial tension" of the outside of the guns is, then, the difference between Mr. Whitworth's and Mr. Armstrong's, between failure and unexampled success; and it is this "initial tension" of the outer parts which I have been advocating for upwards of four years, which I have endeavoured to advocate to-day, as not only beneficial but absolutely necessary when great strength is required.

It is but fair to Mr. Armstrong to state, that, judging from dates, his first gun must have been commenced long before I published my views, although after I had taken a patent and made one or two guns. We, therefore, arrived independently at the same conclusion.

Though I claim to share with him the honour of the invention of the means of obtaining *strength* in cannon, yet the marvellous accuracy he attains, the ingenuity and simplicity of his plan for loading by the breech, the perfection of his fuze, the skilful shaping of his shell and of the inside of his barrel, the scientific way in which he secures the great pressure, guarding against any waste of it; these and many other advantages are due to him and to him only (so far as I know), and I am confident you will all join me in hoping he may receive the hearty gratitude of his country for his patient, laborious, most scientific, and most successful researches.

I will conclude by taking the liberty of entreating any of you whom I have been able to convince of the truth of my views to promulgate them. I venture to make this request now, because every cannon foundry in the kingdom is busy making guns which in a year or two must be obsolete; and because, what is far more dangerous, we are planning expensive means of defending our seaports against guns now in use, against guns which we will heed no more than bows and arrows by the time our defences against them are completed. Those defences I need hardly say will be useless against cannon which can be made, and which in a year or two will be made.

* This was written, it should be recollected, in January last.—EDS. *M.M.*

TOWERS OF STRENGTH.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—All soldiers who have been engaged in "various wars" know that the first object of an active enemy is to rush at and seize upon strong buildings, such as churches, mills, factories, &c., and immediately set to work in fortifying them in such a manner as to cause great loss to those who would endeavour to retake them. All our churches are strong buildings, generally fortified with towers. In the event of

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invasion, I would defend such buildings with my frictional grenades, which can be made to explode with unerring certainty within five or six feet of the ground, whatever height the building may be of, high church or low.

This frictional grenade formed one of the many practical experiments I recently made at Chatham with the sanction of his Royal Highness the Commander-in-Chief, and the late Secretary of State for War. Captain Lemprière, R.E., who superintended the experiments, reported of the frictional grenades that they answered admirably. Having obtained permission from Mr. Jones, proprietor of the far-famed Rosherville Gardens, I shall with great pleasure show the manner of using my grenades to all persons wishing to understand it, as well as other experiments, such as were practically demonstrated at Chatham; Mr. Lock, the instructor of rifle practice on the grounds, will assist me in the course of the experiments. I am, your obedient servant,

J. Norton.

Rosherville, 25th July.

BOAT-LOWERING APPARATUS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—As Mr. Clifford is inclined to rate you for the publication in your Magazine of a statement made by some anonymous and untruthful individual, having reference to what he terms the *alleged* loss of a boat's crew of Green's ship Orwell, I can do no less than furnish you, for your own special information, with the source from which the original statement is derived, backed up with two other documents which further tend to confirm its truth.

The rank and position held by the original informant, you will admit, render his authority unquestionable, while the matter of the documents herewith enclosed being entirely derived from Mr. Clifford's immediate supporters, are not to be objected to, on his side at any rate. The first of these witnesses states that although assured of the truth of the Orwell's deplorable disaster by Mr. Green's officers themselves, that the fault which occasioned it was attributed to the "*lowering man*," and that no blame was attached to the apparatus itself. The second, you will observe, is silent altogether as to the cause of the catastrophe, but dwells on the fact of *two* only of the boat's crew having been drowned, the remaining two having died subsequently through want of food and *exposure to a snow-storm* (a condition of the atmosphere, one would imagine, fatal to the safe working of Mr. Clifford's pendants and nip-sheaves). Be it as it may, these two versions of the affair do not by any means tend to remove the veil of mystery which hangs about it, and it is to be regretted, therefore, that Mr. Clifford, professing as he does to work for the public good, confines the terms of that part of his last letter to a short phrase of exoneration of his plan on the part of Messrs. Green and the master of the Orwell, leaving the public totally in the dark in those points of detail on which the latter would necessarily desire to be informed. By leaving the matter thus in its incomplete shape, would seem to offer a parallel, as far as the public curiosity is concerned, to the testimonial afforded by some imaginary proprietor of a coal mine to disaster of another sort, which we will suppose, for the sake of illustration, to run thus:—

"Dear Sir,—With reference to your note just received, I beg to inform you that the explosion of fire-damp in the mine of which I am the proprietor, which caused the melancholy loss of all the workmen engaged in it at the time, is not attributable to the Patent Safety Lamp of your invention, which they carried in their hands, and no blame whatever can be attached to that valuable invention. "I am, &c., &c."

The remainder of Mr. Clifford's letter is not remarkable for its accuracy, more especially in that passage where he arrogates to his invention the merit of *standing alone* in the great cause of saving human life; he must be well aware (indeed the public in general, for the fact went the round of the public journals), that the captain of the Euryalus, (the second ship supplied with Captain Kynaston's life-hooks), bears record to the fact of a seaman's life being saved by this method under somewhat difficult circumstances.

It seems, moreover, that Mr. Clifford's frequently expressed desire of competitive trials being ordered between the two methods, has been always forestalled, and that trials are in progress, and, as far as I can glean, more especially in the case of the Exmouth and Topaze, that these trials have not been favourable to Mr. Clifford.

The test of time, and changes of the atmosphere, I may observe, are the chief enemies to Mr. Clifford's arrangements; and surely as a naval officer of some practical experience and long sea service, I may hardly with reason be accused of preaching mere vague theories to a person of an opposite calling, who although he may have invented an ingenious plan for lowering boats, and has frequently been lowered in them himself, can have no experience in the ever-varying changes of a ship's voyage, and the means of adapting any part of our naval economy—management of boats included—to meet them. I remain, Gentlemen,

Your obedient servant,

Nauticus.

July 24th, 1859.

[Complaint has been made to the effect that it is unfair to Mr. Clifford to permit this boat-lowering controversy to be pursued on one side by an anonymous correspondent. It is said that while Mr. Clifford is made rigidly responsible for every word he utters, his opponent is practically irresponsible, and cannot be made to suffer the just recompense of any inaccurate statements which he may please to make. Readers must be aware that the question thus raised is both a delicate and a serious one. On the one hand, we cannot for a moment admit that there is any unfairness in anonymous correspondence itself; nor can we undertake to debar ourselves from inserting the communications of those gentlemen who, from holding high offices, or from other causes, are precluded from using their name in public controversies. On the other hand, we readily acknowledge that when questions of fact, of momentous importance to one of the disputants, are raised, as they have been in the present dispute, there is some risk of the anonymous writer exposing the other to an ordeal to which he would himself object. Consequently, after deliberation, we have decided that it will be better to bring the present discussion to an end. We have all confidence in the integrity of "Nauticus," and our readers have had ample proof of his ability; but notwithstanding these things, we think full justice to Mr. Clifford requires that the grave questions of fact which have been raised should not be further discussed by a gentleman whose position imposes anonymousness upon him. The resolution we have come to in this matter must be attributed solely to the *nature* of the subjects discussed; we would never for a moment think even of forcibly closing a purely argumentative discussion on the grounds just stated. At a future time "Nauticus" will, we trust, be relieved from his present restraint.—Eds. *M. M.*]

NOTICES.

The Mechanics' Magazine will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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Our Weekly Gossip.

The Commission, consisting of Professors Faraday, Hofmann, and Tyndall, Mr. R. Redgrave, R.A., and Capt. Fowke, R.E.,—appointed for the purpose of reporting to the Lords of the Committee of Privy Council on Education "On the lighting of picture galleries by gas, and on any precautions (if necessary) against the escape of gas, and the products of its combustion"—having met at various times and considered the subject referred to them, now make the following report:—There is nothing innate in coal gas which renders its application to the illumination of picture galleries objectionable. Its light, though not so white as that of the sun, is equally harmless; its radiant heat may be rendered innocuous by placing a sufficient distance between the gas jets and the pictures, while the heat of combustion may be rendered eminently serviceable in promoting ventilation. Coal gas may be free from sulphuretted hydrogen compounds, and in London is so at the present time; it then has little or no direct action on pictures. But it has not as yet been cleansed from sulphide of carbon, which, on combustion, yields sulphurous acid gas capable of producing 22½ grains of sulphuric acid per 100 cubic feet of present London coal gas. It is not safe to permit this product of the combustion to come in contact with pictures painted either in oil or water colours; and the Commission are emphatically of opinion that in every system of permanent gas lighting for picture or Sculpture galleries, provision should be made for the effectual exclusion or withdrawal of the products of combustion from the chambers containing the works of art. The Commission have examined the Sheepshanks' Gallery as an experimental attempt to light pictures with gas, and are of opinion that the process there carried out fulfils the condition of effectually illuminating the pictures and at the same time removing the products of combustion. According to the indications of the thermometer required and obtained, it does this in harmony with, and in aid of, the ventilation, and does not make a difference of more than one degree Fahrenheit at the parts where the pictures are placed, between the temperatures, before and after the gas is lighted. Certain colour tests consisting of surfaces covered with white lead, or with vegetable and mineral colours (especially the more fugitive ones), and in which also boiled linseed oil, magylp, and copal varnish were employed as vehicles, had been prepared, and were, when dry, covered one fourth with mastic varnish, one fourth with glass, one fourth with both mastic varnish and glass, and one fourth left uncovered. Sixteen of these have been placed for nearly two years in different situations, in some of which gas has been used, in others not. They give no indications respecting the action of coal gas (except injury from heat in one placed purposely very near to and above the gas burners), but seven of them shew signs of chemical change in the whites, due to either a town atmosphere or want of ventilation. The most injured is that from the National Gallery, Charing Cross, and the next is from a country privy; the third much less changed is from the House of Commons; the fourth is from the Barber Surgeons' Hall; the fifth from the Bridgewater Gallery; the sixth from the Royal Society's Rooms, Burlington House; the seventh from the British Museum. The remaining tests hung in:—1. Sheepshanks' Gallery, South Kensington. 2. Secretary's Room at South Kensington, where no gas is used. 3. Mr. Henry Drummond's Drawing-room at Albury Park, Surrey. 4. Sealed up and kept in a closet in the Secretary's Room at South Kensington. 5. Lambeth Palace, Vestibule of the Staircase. 6. British Institution, Picture Gallery. 7. Windsor Castle, room with a north aspect without gas. 8. Mr. Thomas Baring's Picture Gallery, 41 Upper Grosvenor-street, frequently lit with gas—present no observable change in this respect. Though apart from the especial subject submitted to the Commission the Members cannot resist a recommendation that this kind of trial, which is especially a painter's experiment, should be continued for a longer period, and, indeed, be carried out on a more extensive scale. The Commission think it right to state that they were unanimous on all points to which their attention had been called, or which are referred to in this report.

A correspondent, a "Civilian," writes:—"In reading your article this week on the subject of rifled guns, it has struck me that what we want for immediate use is a rifled ball that can be applied at once to our smooth-bored artillery, not only in the navy, but all over the world. I should imagine (and would lay the case before inventors of warlike instruments for their consideration) that an elongated ball, with three or four spiral grooves cut into it, would by the action

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of the exploding powder be made to rotate, and in very many respects resemble in its action a ball shot from a rifled cannon, and that smooth-bored guns furnished with such balls would partake very much of the quality of rifles."

A practical shipbuilding friend sends us the following useful memorandum:—"You are aware that yellow metal sheathing has recently failed to an extraordinary extent. It has been very usual to discover indications of galvanic action between the nail heads and the sheet metal. In the sample I send you herewith, it appears that the nail head, on the contrary, has preserved the sheet; and if you break the part of the sheet which is left in the reticulated state of the piece sent all over the ship's bottom, the fracture appears to be rather that of copper than of yellow metal; as if the zinc had been decomposed and the copper of the yellow metal composition left." The specimen forwarded entirely bears out these statements.

The following needs no introduction:—"Sidmouth, July 20, 1859. Gentlemen,—May I take the liberty to draw your attention to a little circumstance connected with the Electro Magnetic Coil. I some time since fitted myself up a machine according to directions as given by Bentley in the MECHANICS' MAGAZINE, No. 1769, for July 1st, 1857, with the exception of my primary wire being stouter than those recommended, No. 10½, 30 yards long, instead of No. 14, with a condenser of about 130 series, 6 by 12, formed with stout writing paper, enclosed between two sheets of thin gutta-percha, so that the tin foil may be thoroughly insulated; my secondary wire is about two miles in length, No. 35. I find by applying a graphite battery of 12 pair of plates, 3½ by 6 in., is gives a very smart spark and very rapid; but if I take one of the pairs of plates and use 11 as a battery, and apply the poles of the remaining one to the poles of the former, connecting the zinc poles with each other, as also the graphite poles, the power is increased to a surprising degree, the magnetism in the core being increased three fold, and the spark at the terminals of the secondary wire proportionably exalted. Not having seen the circumstance mentioned, I am not aware if the fact has been before discovered. Perhaps some of your numerous correspondents who might have a similar apparatus would be kind enough to try the experiment, and give the result through the MECHANICS' MAGAZINE. Yours respectfully, S. CHICK.—P.S. I find the same proportionate amount of power in a less number of plates, say 6 pair with the extra plate. The magnetism being so much increased, would it not prove a very superior arrangement for the magnetic engine. I have not had time to vary the number of plates in the secondary battery; probably a still greater power would be obtained by a series.—S. C.

Viscount Carlingford writes:—"To the Editors of the MECHANICS' MAGAZINE. Gentlemen,—Allow me to trouble you with the reply I forwarded to *The Engineer*, in answer to a letter addressed to you, therein inserted; your obedient servant, CARLINGFORD." "To the Editor of the *Engineer*. Sir,—In reply to the letter of Mr. Robert Griffiths, in your last number, I trust you will allow me to inform him through your paper, that so far from claiming to be the inventor of his patent screw propeller, he will find on referring a second time to my two letters, published in the MECHANICS' MAGAZINE, that I have condemned its principle as regards its adjustable pitch. But let me inquire of him the reason he takes a new patent for that which he states he took a patent for ten years ago, while only five years ago the Admiralty had condemned all screw propellers then in existence, so much so that Government had ordered that no vessel worked by the screw should be employed to carry Her Majesty's mails? Then is it not clear that Mr. Griffiths has applied the pitch of the Carlingford screw to his old patented screw propeller, and now takes a new patent in the hopes of making the public believe that he is the inventor or discoverer of the new principle, which I alone discovered, and which alone gives to his screw propeller its new qualities. I trust the Admiralty will now see the propriety of giving the screw I presented to them and the country its proper name of the Carlingford Screw, and not insist further on calling it the Admiralty Screw—for none at the Admiralty had anything whatever to do with its discovery—and so put a stop to all persons in future attempting to take on themselves the merit of the real discovery by merely making some trivial alteration to some part of it which had nothing whatever to do with its principle, and then call it a new invention of their own. I might as well bore holes in the chimney of a locomotive, and, taking a patent for it, call the entire my own invention. I remain, Sir, your obedient servant, CARLINGFORD. Swifte's Heath, 18th July, 1859."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 2830, 2857, 2858.
BOILERS AND THEIR FURNACES, 2838, 2847, 2866.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2850.
SHIPS AND BOATS, including their fittings, 2825, 2844.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2828.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2865.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2833, 2845, 2849, 2850, 2862, 2867.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 2822, 2834, 2837, 2840, 2846.
LIGHTING, HEATING, AND VENTILATING, 2824, 2837, 2843, 2844, 2846, 2854.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2819, 2820, 2823, 2826, 2827, 2829, 2841, 2842, 2852, 2854.
METALS, including apparatus for their manufacture, 2831, 2847, 2859.
CHEMISTRY AND PHOTOGRAPHY, 2820.
ELECTRICAL APPARATUS, 2835, 2836, 2864.
WARFARE. *None.*
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 2830, 2832, 2834, 2839, 2848, 2851, 2853, 2855, 2856, 2860, 2861, 2863.

2810. G. F. CHANTRELL. "Improvements in apparatus applicable to the manufacture and revivification of animal or vegetable charcoal." Dated December 8, 1858.

This relates to apparatuses patented on the 17th October, 1853, and 8th June, 1855, and consists, 1, in causing an agitation in the char during the time it is being passed down through narrow retort chambers, in which it is being burnt. This is accomplished by forming the inner surfaces of the retort chambers corrugated, the hollows and rounds of which corrugations by preference should run horizontally. 2. In forming of corrugated metal the corrugated coolers into which the char falls after having been acted upon in the retort chambers. The object of the patentee in forming the coolers of corrugated metal is to obtain a greater amount of surface, and in the construction of it lighter sheets of metal may be used. He prefers in this case that the hollows and rounds forming the corrugations should run in a vertical direction. 3. In forming the upper parts of the pipes or passages which connect the bottoms of the retort chamber with the coolers of as great a horizontal sectional area as the retort chambers for a given distance below the bed-plates upon which the furnaces and char chambers are built. The communication pipes are then divided into two barrels, so that one-half of the char will run into the right hand cooler, and the other half into the left hand cooler, two coolers being used in conjunction with each chamber. 4. In forming on or fixing to the under side of the bed-plates, at the bottoms of one or more sets of the char chambers, a hump of iron, perforated with say six hopper-mouthed holes for the passage of the char. The holes in the iron humps are carried down in an oblique direction on alternate sides for dividing the charcoal, so that it may fall into two coolers, suspended parallel to each other, below the vertical char chambers. *Patent completed.*

2811. C. DE CAPPOT and A. JARRIANT. "A new hydraulic counter." Dated December 8, 1858.

The patentees attach to the pipe from the main or other suitable supply a flanged pipe connected to a cock or tap, the pipe from which opens outwards at the bottom in the shape of a truncated cone, and is flanged at the bottom, so that it may be connected to a case enclosing a cylinder of gutta-percha, &c., having any suitable number of perforations, though the decimal ratio will be found preferable, the solid part of the cylinder being indented when necessary. The patentees connect to the aforesaid case a box communicating by a pipe with one of the holes of the gutta-percha cylinder, and also by another pipe to a bucket wheel, formed with any required number of buckets, starting from about the centre of the wheel, and sliding against the interior of the casing, at the bottom of which there is an aperture covered with wire gauze, &c. To the lower part of the case containing the gutta-percha cylinder, they connect a pipe for giving the supply. They cause the shaft of the bucket to work any suitable gearing, having hands pointing to any number of dials, so that the exact quantity of the water passing through one hole of the gutta-percha cylinder can be measured, which sum multiplied by the number of holes in the said cylinder will give the amount of supply. *Patent abandoned.*

2812. R. L. P. MANNING. "A floating paddle-wheel." Dated December 8, 1858.

Here the inventor fixes two or more cylinders or drums to the sides of sailing vessels, making them of any suitable metal or material, and also water-tight and air-tight, by which he increases the buoyancy of the vessel, and consequently its speed in sailing. For steam-vessels he gives the said cylinders or drums a rotary motion from the crank-shaft of the engine, or by other suitable means, and by attaching paddle-boards to the surfaces of the said cylinders or drums, either transversely or diagonally, but the latter in preference, he obtains a very effectual and powerful means of propulsion. *Patent abandoned.*

2813. M. HENRY. "Improvements in twisting fibrous materials, and in machinery or apparatus employed therein." (A communication.) Dated December 8, 1858.

The patentee claims, 1, the mode of twisting fibrous materials by bringing threads or yarns on to a reel, roller, wheel, or spool from off a number of bobbins, arranged on the same rapidly revolving spindle, the twisted threads or yarns passing between a cylinder and a pressure plate, or between two twist regulating rollers at the upper part, so that if desired they may be gassed, glossed, or dressed during the progress of the operation. 2. The general arrangement and combination of parts and mode of action of twisting apparatus, consisting of a spindle above, or at the end of which are situated a cylinder and pressure plate or two twist regulating rollers, and which spindle carries two or more bobbins, so arranged that their threads or yarns may be united between the cylinder and pressure plate or between the regulating rollers. 3. The method of action or combination of parts of centrifrugal self-acting stop or arrrangement described, in which a thread guide held in place by the thread or yarn itself as it passes, is released when such thread or yarn happens to break, and is then thrown outward by the centrifrugal action of the revolving or twisting appliance, and in which also the wheel roller or reel on which the thread is being wound is provided with a key or a bolt and a stud or stop, the former causing it to partake of the rotary motion of the shaft on which it is carried, but not preventing its being loose thereon when disconnected or disengaged by the stud or stop. 4. The application of centrifrugal force for effecting the self-acting stoppage, throwing out of action or disconnecting of the twisting apparatus of throwing or twisting machinery. *Patent completed.*

2814. S. PHILLIPS. "Improvements in sliding window sashes, shutters, and doors." Dated December 8, 1858.

Here the inventor dispenses with the usual pulleys, lines, and weights employed for raising and lowering or sliding sashes, shutters, and doors, and substituting for the same a curved or bow-shaped spring, which is secured to the edge of the sash, so that in use the spring will be compressed between the sash and the sash-frame. At both ends of this spring are mounted small rollers partly toothed and partly plain, forming a ratchet, the ratchet part being furnished with a spring pawl attached to the long spring to prevent the revolution of the roller in more than one direction. These rollers which thus assist the raising of the sash by running smoothly up the sash-frame will in some measure retard its downward movement by being locked in that direction by the action of the ratchet and pawl, which will thus overcome the tendency of the sash to fall by its own weight. *Patent abandoned.*

2815. A. LAMB and W. A. SUMMERS. "Improved arrangements of apparatuses for super-heating steam." Dated December 8, 1858.

The object here is to divide the steam to be superheated into as thin films or streams as may be in order to get the whole quantity composing such films or streams quickly, thoroughly, and economically superheated. The steam is passed through thin channels or ways arranged cylindrically, spirally, or parallel to each other, or in any other suitable direction in the flues, smoke space, uptake, or chimney. The invention applies especially to those boilers known as "Lamb and Summers' Patent Flue Boilers," but is also applicable to other steam boilers. *Patent completed.*

2816. W. KING, jun. "Improvements in apparatus

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for roasting coffee and other substances." Dated December 8, 1858.

Here the inventor forms the cylinder of wire gauze or metal net-work, or perforated plate, and through one of the axles or arms in which the cylinder rotates a sampling or testing tube is fitted, through which a sample of the berries may be taken during the roasting without stopping the cylinder for that purpose. *Patent abandoned.*

2817. C. M. WESTMACOTT. "Improvements in the permanent way of railways." Dated December 8, 1858.

For fixing fish-plates to railway rails, rails to chairs and sleepers, chairs to sleepers, and the separate parts of chairs or sleepers (in such as are made in more than one piece) the one to the other, the inventor employs screw bolts having heads at one end, and right and left handed screws cut on the other. The screw thread which is furthest from the head is formed in a part of the belt which is smaller in diameter than the part on which the other thread is cut. These screw threads receive nuts which are screwed on in opposite directions, and of which one screws to lock the other; or the screw nearest the head is arranged to screw into a hole tapped in the fish-plate or rail, or other part to be secured. In the construction of permanent ways in which transverse sleepers and chairs are employed he places cushions of wood exterior of the chair, and on each side of it, so that the underside of the rail may rest on these cushions. In arranging the chairs for supporting the rails he makes the end of one of the jaws a detached piece, which drops in between the rail and the other part of the jaw, and is secured by a bolt passing through it and through the bottom of the chair, and it is of such a form as when in place to hold the rail without the use of a key. There are various modifications included. *Patent abandoned.*

2818. H. MEIDINGER. "Improvements in electric batteries." Dated December, 8, 1858.

This consists in arranging batteries on the principle of "Daniell's Constant Battery," as hereafter described, avoiding the use of a diaphragm, and protecting the zinc from being too rapidly touched by the sulphate of copper. For this purpose a large vessel of glass is fitted partly, say two-thirds, with a diluted solution of zinc, and another glass of half the height and diameter of the larger vessel is placed within it, standing in the solution. The second glass is covered on the inside with a copper plate to serve as the negative pole of the battery, and a copper wire is fixed to the plate. This wire is covered by a small glass tube, so as to protect it from the liquid through which it passes. The mouth of the exterior vessel is closed by a cock in which are two holes, one for holding a large and high glass tube, the other for holding a strip of amalgamated zinc. The former, closed at the lower end with a permeable fabric, is plunged into the small glass, and kept full of sulphate of copper. This forms a solution within the interior vessel, and the negative pole is thus constantly kept in contact with a solution of this salt. The zinc is immersed as far as possible from the small glass into the zinc solution. The battery thus constructed serves for a long time, the sulphate of copper never getting at the zinc. *Patent completed.*

2819. R. L. BURROWS and J. KNOWLES, jun. "Certain improvements in the construction of piano-fortes and organs." Dated Dec. 8, 1858.

The object here is to elicit the sound of two notes simultaneously by the touch of one key. It consists in connecting each key (and its individual mechanism) to its corresponding unison key, or octave above or below, by means of a series of rectangular bell cranked levers, the ends of which act upon or strike a projection upon the ordinary "sticker," which is raised by each key, so that the action of each key struck is transferred to its octave above or below, and the two notes are struck and the octave sound produced simultaneously. *Patent completed.*

2820. J. BARROW, jun. "Improvements in the treatment of coal-gas tar, and of the oils obtained by the distillation of the same, and for the application of substances obtained thereby." Dated Dec. 9, 1858.

The patentee submits to the process of distillation in any convenient apparatus a mixture in suitable proportions of coal-gas tar and any one or more of the bodies known as the oxyde of amyl, the chloride of amyl, the hydrated oxyde of amyl, the acetate of amyl, or the carbonate of amyl, with or without the addition of the hydrated oxides of ethyl or methyl or of bodies derived therefrom. There are various modifications included. *Patent completed.*

2821. H. MAUDSLAY. "Improved glass and other vitreous vessels." Dated Dec. 9, 1858.

This consists in applying sulphuric acid to the tools used when operating upon vitreous substances in the same manner as oil is usually employed in lubricating the tools used when operating in a similar manner on metals. *Patent completed.*

2822. J. ECCLES. "Improvements in arrangements and machinery for preparing for the manufacture and for manufacturing clay and other plastic earths into bricks, tiles, pipes, and other articles formed of such materials." Dated Dec. 9, 1858.

The object of the first part of this invention is to prepare clay and other plastic earths direct from the bed ready to be moulded by machines acting on the principle of those known as "dry-clay machines," in which system the process of tempering or pugging the materials is unnecessary. The invention consists in drying the clay-earths by currents of hot or cold air, produced by mechanical means as follows: The clay-earth is passed through one or more pairs of rollers, which deliver it on to a travelling endless belt, apron, or lattice (upon which it may be broken up into small particles); this arrangement conveys the clay-earth to any suitable distance, and while in progress it is subjected to heat and to a current of hot or cold air, so that by the time the travelling arrangement has conveyed the material to its point of delivery it has been dried sufficiently to be ready for moulding into bricks, &c. It relates, 2, to apparatus for moulding articles by expressing plastic earths through moulding orifices, and consists in a method of securing the moulding cores so as to keep them more correctly in their places. This is accomplished by a stay or stays in addition to the usual means. *Patent completed.*

2823. H. BELL. "Improvements in musical instruments." Dated Dec. 9, 1858.

This relates to the improvements of the tone of violins and other musical instruments by the introduction or addition of a "bell harmonica." As applied to a violin, this consists of a flattened tube or elliptical chamber of glass placed in the interior of the body of the violin, the two ends of this glass piece being carried by two end blocks of wood. These blocks are supported by a light pole or bar of wood fastened to the ends of the instrument, and passing along the interior of the glass sheet. A bow-shaped bar of lancewood is placed transversely across the body of the instrument above the glass shell to support a sound-post, the top of which carries the breast of the instrument. *Patent abandoned.*

2824. J. LITTLE. "Improvements in fire-grates and heating apparatus." Dated Dec. 9, 1858.

This relates, 1, to open fire-places such as are used for domestic purposes in the warming of apartments, and it consists under such modification of the attachment to the front of such fire-places or grates of vertical or horizontal radial plates of metal, as a means of obtaining a superior amount of effective and available heat, and for improving the draught. *Patent abandoned.*

2825. J. ELDER. "Improvements in paddle wheels." Dated Dec. 9, 1858.

The patentee employs plates of steel or iron of a thickness proportioned to the unsupported surface of the float, and to the maximum pressure to which it may be subjected. He bevils the edges of these metal plates, giving them a suitable angle, so that when applied as floats they will, on entering and on leaving the water, present the minimum of the resistance due to the thickness of such floats. *Patent completed.*

2826. J. STEWART. "Improvements in the construction of the action of piano-fortes." Dated Dec. 9, 1858.

This consists in mounting the escapement button on the fly or hopper, and at such an inclination that just as it comes against the surface of the projection it is moving in a direction perpendicular to that surface. *Patent completed.*

2827. T. ALLEN. "Improvements in folding bedsteads." Dated Dec. 9, 1858.

The two side-rails are here by preference made of metal tubes. Each side-rail is made to fold by having one or more rule-joints formed thereto. The sacking is folded at its edges and sewn over the side-rails. Towards the ends of the side-rails and on the under sides thereof are projections to enter the sockets of the legs or supports. It is preferred to cast such projections of malleable cast-iron, in the form of T-pieces, so that two of the parts of the tube forming a side-rail may in each case fit on and be fixed to such T-piece. The two pairs of legs used for each bedstead are crossed, and have sockets at their upper ends to receive the projections on the under sides of the side-rails. The head frame is formed of metal and covered with canvas or other fabric, and it has a projection at each end which enters a hole in the side-rail. *Patent completed.*

2828. J. WILSON. "Improvements in machinery for tilling and cultivating land." Dated Dec. 9, 1858.

Here a chain or rope is employed which has an anchor or suitable fixing apparatus at each end so as to hold the same fast at or near the headland towards which the tilling or cultivating implement is being moved. A suitable carriage, by preference on four wheels, is constructed so as to carry a chain wheel-drum or pulley, which receives motion from a steam-engine, which, with its boiler, is carried by the carriage. The ploughs or other implements are attached to and dragged by the carriage, and to prevent turning the carriage and implements at the end of each bout, two sets of ploughs or implements are employed, so that one set may be in and the other out of action at each bout. The chain used is conducted partly around the chain-wheel by guide-wheels, so that as the chain-wheel is caused to rotate, it will, on the carriage passing from one headland to the other, pick up and again deposit the chain; and the end of the chain from which the carriage is for the time being moving, will have its anchor or holding apparatus moved, so that in the next bout the carriage and implements will act on a fresh portion of the land. *Patent completed.*

2829. H. WILSON. "Improvements in the construction of pumps." Dated Dec. 9, 1858.

This consists in the introduction into pumps of a plate of brass or other metal to which are attached two or more suction pipes leading into different directions. On the other side of this plate another plate is ground air-tight, and is made to work either with a circular, semi-circular, or lateral motion; the sliding plate is perforated with one or more holes, so that when the holes in the sliding plate are opposite the holes in the stationary plate, the water or other fluid may be drawn by the action of the pump from one or more different sources as may be required. There are modifications included. *Patent completed.*

2830. E. L. PENSUETE. "Improvements in apparatus for driving or for drawing up piles by steam." Dated Dec. 9, 1858.

Here a framework of timber say 45 feet high, is furnished with a steam cylinder fitted up with a piston and hammer. This said cylinder has connected to its lid at opposite points two strong metal rods, and to the lower extremities of the said rods a casting is fixed, the same being provided with two right and left handed screws on which are placed two moveable jaws, by which it is proposed to embrace firmly the head of the pile. As the pile is drawn by elastic force of the steam, the steam cylinder follows the pile, and when driven sufficiently far, the jaws are released from the pile, and the cylinder raised by connecting a chain to the top thereof. This chain passes on to a barrel or drum placed on the platform of the machine and is worked by a small steam engine, so that for drawing piles out of the ground it is only necessary to fasten the before-mentioned jaws round the head of the pile, and then to wind the chain around the barrel, at the same time gently tapping the head of the pile with the hammer. *Patent completed.*

2831. B. LAUTH. "An improved mode of manufacturing rods and shafts." Dated Dec. 9, 1858.

Here the patentee takes the ordinary rolled rod of commerce of whatever size required (which is produced by passing the metal while red hot between grooved rolls) and immerses it in dilute acid to remove the scale therefrom. This immersion is not, however, required except when the article to be produced is intended to have a bright surface. When washed in water and dried he passes the cold rod between a pair of steel rolls formed with a series of grooves, which have the edges of the grooves rounded off to prevent ridges or lines being formed on the rod. The cold rolling is repeated as frequently as may be necessary, the rod being turned round as the rolling proceeds. *Patent completed.*

2832. J. BETHELL. "Improvements in machinery and apparatus for the preservation and colouring of wood. Dated Dec. 10, 1858.

This consists in protecting the iron cylinders used for preparing wood with chemical solutions from the action of acids by first lining the inside of the cylinders with sheet lead, caoutchouc, or gutta-percha; after the interior of a cylinder is so protected the inventor constructs another lining of wood. *Patent abandoned.*

2833. J. LIGHTFOOT. "Improvements in printing or staining yarns, fabrics, or fibrous substances, and in the manufacture of certain compounds for that purpose. Dated Dec. 10, 1858.

This consists in making an alkaline solution of colouring matters and metallic oxides, with which, when thickened, the patentee prints fabrics or yarns, putting the said fabrics afterwards through a subsequent process for developing and fixing the colour. *Patent completed.*

2834. J. FLOCKTON. "Improvements in stop or reversing taps." Dated Dec. 10, 1858.

For preventing the loss of time in working a series of hydraulic presses, the inventor employs a stop

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reversing tap, having a chamber with three apertures, one of which is connected to the supply pipe from the pumps, another to one hydraulic press, and the third aperture either with a stop or reversing tap, or with a waste pipe. One or the other of the two latter apertures are opened or closed by two valves placed upon one spindle, the top of which has a screw working in a nut, which screw with the spindle and valves are turned by a handle, the position of the valves being so arranged that when one aperture is open the other is closed; by simply turning the handle the aperture from the pumps can be opened to the press until the desired amount of pressure is obtained, after which the handle is turned so as to close the first aperture and open the other, which communicates with the aforesaid similar stop, or reversing tap or waste pipe, and so on for the entire series of presses, one of the apertures of the last tap being connected with the waste-water pipe. *Patent abandoned.*

2835. A. BARCLAY. "Improvements in electric, magnetic, and electro-magnetic telegraph ropes or conductors." Dated Dec. 10, 1858.

Here the component wires of such ropes or cables are twisted after the fashion of a common rope. The wires may be separated from each other by mechanically separative matter only, or by an insulating medium, or by both. *Patent abandoned.*

2836. A. BARCLAY. "Improvements in obtaining motive power by means of electricity, magnetism, and electro-magnetism." Dated Dec. 10, 1858.

This relates to the obtainment of motive power upon the galvanometrical principle. Any form of galvanometer may be used, and one or more bars or magnets may be used to work on the same centre of motion. The needle bar or apparatus of this galvanometer is surrounded by one or a series of stationary galvanometrical coils, between which and the galvanometer needle or bar there are disposed suitable make and break contact apparatus to put the poles of the galvanometer into and out of electrical or magnetical contact with the source of electrical or magnetical power passing through the galvanometrical coils. With this apparatus a continuous and effective rotary action may be secured. The machinery is preferred to be all secured in a suitable chamber from which the air may or not be exhausted. It is also intended to place rotatory electrical or magnetical apparatus in the interior of an enclosed chamber for the purpose described, the air being exhausted or not. *Patent completed.*

2837. C. HODGSON. "Improvements in the manufacture of fuel from peat, and in apparatus employed therein, part of which is also applicable to the moulding of bricks, tiles, and other plastic materials." Dated Dec. 10, 1858.

This consists in means of cutting peat from bogs, in converting it into pulp by tearing machines, drying it on steam-heated tables, and finally forming it into solid lumps by means of a ram working tightly in a tube into which the peat is fed. The moulding part of the invention is applicable to bricks and other like articles. *Patent completed.*

2838. W. BEARDMORE. "Improvements in steam boilers." Dated Dec. 10, 1858.

Here the steam passing from the steam chests of boilers is passed by the patentee through tubes situated in the uptake or flue leading to the chimney or funnel, and thereby becomes superheated before being supplied to the engines. *Patent completed.*

2839. G. F. WILSON. "Improvements in the manufacture of lubricating oils." Dated Dec. 10, 1858.

This consists, 1, in combining rosin oil with oil produced from bituminous or schistose bodies, such as petroleum, bog-head, or other coal or shale, and by preference the rosin oil used is prepared by distilling rosin by surcharged steam, then producing the rosin oil in the ordinary manner, and then distilling such oil by the use of surcharged steam, and by such means body is given to the oils distilled from bituminous or schistose bodies. 2. In the use of rosin oil with cocoa-nut oil or the oleine of cocoa oil, or the oil or oleine obtained from Calhoun palm, or from the oil or oleine obtained from the kernel of the nut from which palm oil is obtained, by which means oils of suitable body for lubrications are obtained. 3. In combining with the compound oil first described one or more of the oils or oleine's secondly mentioned. *Patent completed.*

2840. G. W. B. KIALLMARK and W. T. TIMEWELL. "Improvements in the manufacture of cements." Dated Dec. 10, 1858.

This consists in placing in the kiln, together with the fuel and cement stone, or other materials from which the cement is made, animal matter, such as horse's hoofs, horn, or other similar substances, which being burnt with the cement, stones, &c., improves the colour and quality of the cement. *Patent completed.*

2841. W. F. HALL and T. DUTSON. "Certain improvements in fancy buttons for ladies' and gentlemen's wear." Dated Dec. 10, 1858.

This consists in perforating the front or face shell, the edge of the perforation being of a Vandyke or serrated form, the points of which being bent or pointed outward will puncture the fabric with which the front of the button is intended to be covered, and these sharp points so far project through the fabric, and are made to clip and hold a centre ornament. *Patent abandoned.*

2842. J. B. GUTHRIE. "Improvements in the manufacture of india-rubber overshoes." Dated Dec. 10, 1858.

This consists in the application at certain parts of gores, gussets, or pieces of elastic india-rubber, or india-rubber webbing or fabric, into semi-elastic overshoes. *Patent completed.*

2843. S. DUDGEON. "An improved gas-regulator." Dated Dec. 11, 1858.

Here the gas is introduced by a supply pipe into one chamber of the regulator, and from this chamber it passes into a second chamber, but the amount of gas passing from one chamber to the other is regulated by a valve which is caused to open or close a passage between the compartments more or less as required. The valve for regulating the passage of the gas between the inlet and the outlet chamber is carried by a disc or cover, having turned-down edges which enter a trap containing quicksilver or other fluid. One arrangement for operating the disc or cover with the valve attached is to suspend it upon centres or axes placed near one of its ends. The points of these centres or axes rest against bosses or pads in which the points of the centres or axes work, thereby preventing undue pressure on the cover, which, if screwed too air-tight, breaks the joints and causes an escape of gas. There are modifications included. *Patent completed.*

2844. J. HINKS. "Improvements in ships' and other lamps." Dated Dec. 11, 1858.

The inventor makes the chimney of a slightly tapering tubular form, and at its summit places a chamber the figure of which somewhat resembles two very obtuse cones placed base to base. The chimney opens into the chamber, the upper end of the chimney being expanded so as to have the figure of a trumpet-mouth, and nearly corresponding in shape to the lower half of the chamber into which it opens. In the upper part of the chamber a horizontal diaphgram perforated with holes is placed. The lower side of the chamber into which the chimney opens is also perforated to permit the escape of heated air from the lamp. By this construction the burning of the lamp is unaffected by strong winds blowing upon it, or water dashed upon it. It also consists in making the reflectors of ships' lamps and lamps enclosed in cases, of a series of planes arranged round the flame, so as to be perpendicular, or nearly so, to radii drawn from the lamp. *Patent abandoned.*

2845. P. ROBERTSON. "Improvements in shuttles." (A communication.) Dated Dec. 11, 1858.

This consists in manufacturing shuttles by combining with wood, bone, ivory, or metal the hard material formed from india-rubber; and also in manufacturing shuttles entirely of such material. *Patent abandoned.*

2846. C. J. RICHARDSON. "Improvements in apparatus to be applied to chimneys or flues of buildings, for economising heat and reducing the quantity of smoke passing into the atmosphere." Dated Dec. 11, 1858.

Here branch iron tubes are so arranged in the upper rooms of a building that the heated products of combustion from fires at lower parts of the building may be made to heat the air of such upper rooms, and also, if desired, to heat water in cisterns placed in such upper rooms. *Patent abandoned.*

2847. M. SCHAFFNER. "Improvements in smelting zinc ores, and in furnaces employed for this purpose." Dated Dec. 11, 1858.

Here the calumine or other zinc ore is placed in a chamber or muffle around which a flue from a furnace passes. The top of this chamber is formed with hollow bricks, and the bottom with fire-blocks or tiles which rest on masonry at the two sides, and are also supported between the sides with perforated supports. The blocks or tiles at the bottom of the chamber form the top of a flue from a furnace, and the products of combustion from the furnace enter this flue at one end of the chamber, and pass on beneath the chamber to its other end where the flue rises up, and the products of combustion then pass back above the chamber through the hollows in the bricks forming its top to a chimney, by which means the chamber is sufficiently heated to volatilize the zinc. At one side of the chamber there are holes through which the zinc ore is introduced into the chamber. These holes are closed air tight when the furnace is in operation. From the chamber or muffle pipes descend to a condenser in which the zinc is deposited in a liquid state, and can be run off when desired through a small tap-hole. From this condenser pipes pass to another condenser which arrests the metal which passes away with the gases in the state of dust. From the second condenser a pipe in which there is a valve passes to the chimney, so that by opening or closing this valve the gases may be drawn more or less quickly from the chamber. Registers are applied for closing the pipes at certain periods of the operation. *Patent completed.*

2848. W. E. WILEY. "Improvements in ever-pointed pencils." Dated Dec. 11, 1858.

The holder is attached to the forcer by a swivel so that the holder and marking material may remain without turning in the case, whilst the forcer is rotated to propel the outer end of the marking material up to and through the nozzle of the pencil case. The forcer is caused to rotate within the case by a split tube which is attached to the end of the case. The teeth or projections of the forcer pass through the split tube and enter the threads of the female screw formed on the interior of the case. It is preferred that the nozzle should be fixed to the case, and that the split tube should be fixed to the other or moveable end of the case. A length of marking material is supplied to the holder when the holder and the split tube has been drawn out of the case. *Patent completed.*

2849. A. ROLLASON. "Improvements in the manufacture of waterproof tissues, and in applying such waterproof material to woven fabrics, and manufactured fibrous goods." Dated Dec. 11, 1858.

This consists, 1, in the preparation of a waterproof tissue, which is capable of application as a remedial agent in surgical cases. 2. In the application of this tissue to the coating of woven fabrics and fibrous or textile goods. To make the tissue the patentee mixes collodion vegetable oil (by preference castor oil) and sometimes Canada balsam, mineral naphtha, and spirits may also sometimes be added. The mixture is poured upon glass plates, and the spirit is evaporated from it, after which the tissue may be stripped off the plates and stored away for use. *Patent completed.*

2850. J. A. CARRUTHERS and T. BLACKBURN. "Improvements in apparatus for guiding and regulating the warp threads in the operations of warping, tape sizeing, looming, and weaving." Dated Dec. 13, 1858.

This consists in substituting for the ordinary comb or wraith used in warping and sizeing machines a compound spiral spring in connection with a longitudinal shaft or rod, at the extremities of which are placed right and left hand screws with the necessary nuts or apparatus for working the same, so that by turning handles, levers, or wheels, the inventors are enabled to expand or contract the threads or divisions of the springs equally to any desired pitch, by which a greater or less number of ends or threads of the warp may be placed upon any given width. They also place between the divisions of the compound spiral springs peculiar forms of straight springs, either in separate parts or in one entire piece constituting the desired length of the comb. *Patent completed.*

2851. R. WHITTAM. "Improvements in machinery or apparatus for tracing designs from an engraved roller or from an engraver's sketch upon steel or other metallic surfaces, used as dies by engravers to calico printers." Dated Dec. 13, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2852. L. C. V. YON. "Improved elastic beds." Dated Dec. 13, 1858.

The object here is to facilitate the package of spring mattrasses by a mode of construction which permits of their being folded either in length or in breadth. The mattrasses are divided into different parts, which assume a square, oblong, or other shape, and which are tied together with gutta-percha bands. To give the intended shape, the inventor makes use of hinge springs, and maintains the opening in breadth by rattans. *Patent abandoned.*

2853. J. M. ROUSSEL. "A new system and new apparatus, using air as a motive power." Dated Dec. 13, 1858.

This essentially consists in the use of compressed air. The invention is not described in detail apart from the drawings. *Patent abandoned.*

2854. J. E. BOYD. "Improvements in candlesticks, lamps, and lanthorns." Dated Dec. 13, 1858.

This invention is not described apart from the drawings. *Patent completed.*

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2855. R. A. BROOMAN. "Improvements in twisting and otherwise operating upon threads, twine, or cords, and in apparatus for performing the same." (A communication.) Dated Dec. 13, 1858.

The object here is to perform by machinery certain operations which have hitherto been performed by hand. The invention is not fully described apart from the drawings. *Patent completed.*

2856. R. A. BROOMAN. "Improvements in the manufacture of cranked axles and shafts." (A communication.) Dated Dec. 13, 1858.

This relates to a previous patent, and consists in means of forming the cranks with or without the welding on of additional metal to the bar which is to form the cranked axle or shaft. *Patent completed.*

2857. E. LOOMES. "An improvement in the construction of steam-engines." Dated Dec. 13, 1858.

Here the object is to get the benefit of the reactionary power of high pressure steam supplied to reciprocating steam-engines by causing the steam to enter the cylinders through a moving instead of through a fixed body. To this end the inventor uses a hollow piston rod, which he brings into communication (either through a telescopic arrangement of tubes or otherwise) with the steam supply pipe, and he also makes the piston hollow, and furnishes it with steam ways opening out to opposite sides of the piston. Within the piston he mounts the cut-off valve, the rod of which passes through the centre of the hollow piston rod, and out of the end thereof, which is closed by a stuffing box. By connecting this rod with a crank excentric or its equivalent worked by the engine, the valve may be readily made to cut off the supply of steam alternately from one end of the cylinder, and open a communication between the supply pipe and the other end of the cylinder. *Patent abandoned.*

2858. J. FERRABEE. "Improvements in the construction of steam-engines, and in the mode of working the same." Dated Dec. 13, 1858.

This relates, 1, to a mode of working the cut-off valves of steam-engines, and consists in the use of an arrangement of parts whereby the supply of steam to the cylinder is cut off at any portion of the stroke of the piston by a continuous motion of a cut-off valve, the time of the cut-off being altered by the rising or falling of the governor balls, and the supply of steam to the cylinder regulated without the intervention of a throttle valve. It relates, 2, to the construction and setting-up of the cylinders of steam engines with the view of maintaining or increasing the elasticity of the steam supplied thereto when discharged from the boiler. *Patent completed.*

2859. J. WEBSTER. "A new or improved method of recovering copper and zinc from liquids, which have been employed to dip or pickle articles made of brass or other alloys containing copper and zinc." Dated Dec. 14, 1858.

This consists in a method of recovering copper and zinc from liquids which have been employed to dip or pickle articles made of brass or other alloys containing copper and zinc by treating the liquids with metallic zinc, and thereby precipitating the copper and zinc contained in the liquids, the same being recovered by evaporation and crystallization. *Patent completed.*

2860. E. BOW. "Improvements in pumps." Dated Dec. 14, 1858.

The essential feature here is the use of a kind of "cup packing," which in the piston acts against the barrel surface in such a way as to dispense with a separate piston packing. *Patent completed.*

2861. D. ANDERSON. "Improvements in taps or valves." Dated Dec. 14, 1858.

Here in a modification of a tap or nose-cock the shell of the tap is made in two parts for the introduction of the closing valve, which is a slightly conical plug of metal, or metal covered with caoutchouc, &c. The plug or valve is fixed on a spindle the inner end of which works in a bridge-piece on the back part of the shell, the outer end passing out at the front of the top to a button or handle by which it is operated. The front part of the shell is made conical internally, the narrow end being outward, and the plug closes this space by the pressure of the fluid, or by the pressure of a spring introduced in cases where the pressure in the pipe is insufficient. The tap is opened by pressing in the spindle, and with it the plug which allows the fluid to escape round the plug. In a modification of valve for discharging fluids, &c., the duct or passage is closed by means of a valve working across its mouth, which is faced or ground up, as is also the back of the valve to make a close fit. The valve is made to slide (by preference vertically) in grooves or guides which retain it against the mouth of the duct or passage, and it is moved by a handle fixed to it and projecting in front. There are other arrangements included. *Patent abandoned.*

2862. J. WADE. "Improvements in means or apparatus employed in weaving." Dated Dec. 14, 1858.

The object here is the obtaining facility in changing from plain weaving to twill, &c., and then to plain again. Instead of employing only a pair of treddle levers operated by a pair of tappets to give motion to the heddles, there are four or more treddle levers connected to the heddles, according to the extent of change which it may be desired to produce with a separate lappet or like-acting surface to each treddle lever adapted to produce the required variation in the shedding. And these treddle levers are capable of being connected together so as to form one pair, and then ordinary plain weaving will be produced. Catches operate to connect the two or more levers together, and these connecting means are separated at the times desired by Jacquard or other pattern surface. *Patent completed.*

2863. G. BAKER. "An improved construction of manger fastening." Dated Dec. 14, 1858.

The object here is to secure horses and cattle to their mangers, so that on an alarm of fire being given all the animals occupying a long shed or range of stables may be quickly released without the necessity of entering the several stalls to disengage the animals. To this end the patentee provides a peculiar construction of bolt fastening. *Patent completed.*

2864. R. A. BROOMAN. "An improvement in transmitting electric telegraph signals." (A communication.) Dated Dec. 14, 1858.

This relates to transmitting electric telegraph signals by means of clockwork, and consists in setting free the clockwork and bringing it into action, and stopping it by the current itself. *Patent completed.*

2865. J. T. SMETS. "A method of making vinegar from a refuse product obtained in the manufacture of starch." Dated Dec. 14, 1858.

This consists in a process, which we cannot give in detail, of making vinegar from the residuum which remains in the manufacture of starch, and which is generally used for feeding cattle. *Patent abandoned.*

2866. F. JOSSA. "Improvements in furnaces for generating steam and other purposes." Dated Dec. 14, 1858.

This consists in so constructing furnaces that the fire burns downwards, and thus consumes the smoke." *Patent completed.*

2867. J. PENDLEBURY. "Certain improvements in machinery or apparatus for bleaching or cleansing textile fabrics or materials." Dated Dec. 15, 1858.

This consists in an arrangement of vessels for bleaching or cleansing manufactured or piece goods or yarns of cotton, linen, or other fibrous material by the application of high pressure steam for first boiling the bleaching liquid above 212° in a separate closed vessel, and then forcing such liquid so heated through the goods or fabrics to be bleached, the goods being contained in a closed vessel or "kier" conveniently situated near to the heating or boiling vessel. The liquid after being thus forced in a heated or boiling state through the goods, is returned to the boiling vessel, where it is again heated to the required temperature, and again forced through the goods, such process being repeated until the goods are sufficiently bleached. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated May 27, 1859.

1310. L. D. Jackson. An improved machine for cutting wood.

Dated June 22, 1859.

1498. W. Buckwell. Manufacturing materials for building and other structural purposes, and of the machinery applied thereto, which last invention is applicable to other purposes.

Dated June 23, 1859.

1510. A. J. Dessales. An improvement in the working and securing of sliding tubes, applicable to gas chandeliers, lamps, and other purposes.

Dated June 30, 1859.

1554. A. Gueyton. Improvements in enamelling articles of jewellery, applicable also to other similar purposes.

Dated July 5, 1859.

1598. J. H. Nalder and T. Nalder. Improvements in winnowing and dressing grain and seeds, and in the machinery or apparatus employed therein.

Dated July 6, 1859.

1600. W. H. Ward. Ocean marine signal telegraphing for day and night, whereby messages and communications on all occasions and subjects may be given with clearness and despatch, within seeing distance, day or night.

1608. B. Seed and T. Steel. Improvements in apparatus employed in the treatment of soap suds or other saponaceous or oily matters.

Dated July 7, 1859.

1610. D. T. Jones. Improvements in ploughs.

1611. C. F. Vasserot. An improved form of regulator, chiefly applicable to water-wheels. A communication.

1612. F. A. Le Mat. Improvements applicable to ordnance.

1614. R. C. Rapier. Improvements in working rolls for rolling plates of unequal thicknesses.

1618. J. H. Johnson. Improvements in knitting frames. A communication.

Dated July 8, 1859.

1619. G. Ellis. The improvement of muffs, to be called "the patent reticule travelling muff."

1620. W. H. Dawes. An improvement or improvements in the manufacture of iron.

1622. F. A. Le Mat. Improvements in the construction of revolving or repeating fire-arms.

1624. G. Cartwright. Improvements in corks for bottles and jars.

1625. G. A. Boggis. Improvements in rendering boots and shoes waterproof.

1626. E. Livermore. Improvements in the manufacture of burning fluids for illuminating and heating purposes. A communication.

1627. D. Mathews. Improvements in apparatus for refrigerating and heating liquids.

1628. J. H. Johnson. Improvements in moulding or shaping metals by pressure, and in the machinery or apparatus employed therein. A communication.

1629. W. H. Harfield. Improvements in ships' capstans, and riding bits.

1630. H. Brimsmead and J. Lawrence. Improvements in rotatory screens.

1631. J. Taylor. Improvements in the construction of walls to prevent damp from rising, and also in tiles to be used for this purpose in building walls.

1632. T. D. Duppa. Improvements in carpenters' benches.

1633. W. Woofe. Improvements in ploughs.

1635. W. N. Nicholson. Improvements in clod crushers and land and garden rollers.

Dated July 9, 1859.

1636. M. Henry. Improvements in the manufacture of over-shoes and other articles worn on the feet, and in the apparatus employed therein. A communication.

1637. B. Samuelson and J. Shaw. Improvements in reaping and mowing machines.

1638. F. Ayckbourn. Constructing certain articles of dress, so as to prevent drowning.

1639. C. Iliffe. Improvements in the manufacture of buttons.

1641. E. Livermore. Improvements in generating gas for the purpose of lighting and heating.

1642. J. Smith. Improvements in apparatus for heating and cooling water.

Dated July 11, 1859.

1643. E. F. Hutchins. Constructing the jaw or jaws of vices and holding tools in general with a ball and socket joint."

1644. R. Clegg. Improvements in machines for cutting wood and metal, and in the means of fixing saws thereto. A communication.

1645. H. Davis. Improvements in the manufacture of soap.

1646. J. C. Pickard. Improvements in weft forks for looms.

1647. W. E. Newton. Improvements in magneto-electric machines. A communication.

1648. J. Dible and W. H. Graveley. Improvements in apparatuses for ventilating and lighting ships.

1649. F. Burden. Improvements in the permanent way of railways.

1650. J. A. Hartmann. Improvements in the manufacture of colours for printing cotton and other vegetable fibres and silk.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1690. W. M. Cranston. Improved delivery apparatus for harvest machines. A communication. Dated July 16, 1859.

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NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(From the London Gazette, July 26, 1859.)

637. J. Court. Nibs for gas burners.
638. R. Allison. Boring and sinking.
657. W. Robertson and J. G. Orchar. Weaving.
660. I. Ash. Locks and latches.
668. J. Clark. India-rubber fabrics.
669. G. Hamilton and W. H. Nash. Locks and keys.
671. T. W. Miller. Blocking ships.
672. C. Defries. Lamps.
678. A. G. Hutchinson. Counteracting damp.
679. P. Larochette. Brewing.
690. R. Mushet. Metallic alloy.
691. R. Mushet. Cast steel.
692. A. L. Thirion. Mills
696. W. B. Gingell. Window sashes, &c.
703. R. Mushet. Cast steel.
708. A. Baucq. Graters.
712. J. Roberts. Packings for pistons.
717. W. Rhodes. Fire-proof safes.
719. J. Davies. Musical instruments.
721. W. A. Gilbee. Silk thread. A communication.
722. W. Weild. Coating slips, bars, laths, &c.
727. D. L. Banks. Suspension ways.
730. T. Manlove and W. Hodgkinson. Textile fabrics.
732. J. Tyssen. Indicating the speed of ships.
741. J. V. Hielakker. Pressing or moulding.
752. C. Sanderson. Steel.
778. T. Carr. Disintegrating substances.
790. W. Brown. Clog-soles.
800. A. V. Newton. Governor. A communication.
818. W. E. Newton. Cricket bats. A communication.
993. J. Wotton. Shaping metals.
1222. L. D. Owen. Truss. A communication.
1268. C. P. Moody. Matting.
1270. F. J. Bramwell. Raising ships. Partly a communication.
1410. F. Puls. Hydro-carbons.
1542. J. Nash. Disengaging block.
1544. A. McDougall. Disinfecting substances.
1552. G. Baker. Trellis work. A communication.
1590. R. A. Brooman. Hemmer for sewing machines. A communication.
1598. J. H. Nalder and T. Nalder. Dressing grain.
1599. J. Watkins and J. Pugh. Lubricating wheels.
1613. J. Knowelden and D. Edwards. Hydraulic engines.
1627. D. Mathews. Refrigerating and heating.
1637. B. Samuelson and J. Shaw. Reaping and mowing.
1639. C. Iliffe. Buttons.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 22, 1859.

202. B. Templar.
203. E. Dorsett and J. B. Blythe.
212. R. A. Brooman.
213. J. Laubereau.
214. J. Smith and W. H. Smith.
215. J. Savory and W. R. Barker.
217. A. Warner and W. Tooth.
227. J. White.
238. D. Graham.
240. F. C. C. Paulsen and A. Alsing.
370. W. E. Newton.
395. T. Willis and G. Chell.
617. A. V. Newton.
833. T. Richardson and G. W. Jaffrey.
851. L. Brierley and H. Geering.
1263. W. Crum.

Sealed July 26, 1859.

246. E. Dixon and H. Whittaker.
253. W. Crowther.
254. J. Gathercole.
255. I. Zacheroni.
259. F. Prince.
266. J. MacKenzie.
270. J. J. A. de Bronac and A. J. M. Decherrypon.
272. T. P. Smith.
274. J. Raywood.
289. R. A. Brooman.
297. E. Wilkins.
307. T. Storer.
330. W. Clark.
342. M. Curtis & J. Miller.
343. J. Lee.
359. T. S. Cressey.
373. H. P. Burt.
388. R. Cogan.
390. C. Jackson.
412. J. L. Clark.
451. C. Garton.
529. J. H. Johnson.
662. H. Ambler.
875. J. Bindley and J. L. Hinks.
948. J. Chapman.
1158. J. Luis.
1228. C. Law.
1319. W. Crum.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1707. W. A. Jump.
1708. W. A. Jump.
1711. W. Papineau.
1715. E. Leak.
1719. J. Clark.
1725. J. E. Hodges.
1729. C. Amet.
1741. F. Potts.
1742. J. Onions.
1748. H. Doubleday.
1749. J. Derbyshire.
1759. G. A. Copeland.
1760. C. A. Judkins.
1766. E., T., A., and W. Lord.
1768. T. Byford.
1770. T. Wrigley.
1776. J. Denis.
1781. S. Yeadon and G. Chapman.
1793. J. Knowles and W. Buxton.
1810. W. E. Newton.
1834. N. Cadiat.
1984. W. H. Perkin.
2021. H. Conant.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending July 23, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
2783	1 5	2879	0 3	2892	0 10	2905	0 7	2918	0 3	2931	0 3
2836	0 11	2880	0 3	2893	1 3	2906	0 3	2919	0 3	2932	0 3
2848	0 7	2881	0 3	2894	0 3	2907	0 5	2920	0 6	2933	0 9
2855	0 7	2882	0 7	2895	0 3	2908	0 6	2921	0 4	2934	0 3
2867	0 6	2883	0 4	2896	0 7	2909	0 3	2922	0 3	2938	0 3
2870	5 8	2884	0 10	2897	0 8	2910	0 7	2923	0 3	2941	0 3
2871	0 7	2885	0 5	2898	0 6	2911	0 3	2924	0 11	2943	0 3
2872	0 7	2886	0 6	2899	0 10	2912	0 3	2925	0 8	2944	0 5
2873	0 10	2887	0 3	2900	0 5	2913	0 5	2926	0 3	2946	0 10
2874	0 9	2888	0 7	2901	0 6	2914	0 8	2927	0 3	2947	0 3
2875	0 9	2889	0 3	2902	1 1	2915	0 3	2928	0 3	2948	0 3
2876	0 6	2890	0 3	2903	0 3	2916	0 7	2929	0 3	2949	0 3
2877	0 3	2891	0 5	2904	0 10	2917	4 2	2930	0 3	2951	0 3
2878	0 4										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
June 24,	4184	J. Cornes, Barbridge Works, Nantwich	Cheese making apparatus.
„ 27,	4185	H. Naylor, Sheffield	Engravers' assistance.
„ 29,	4186	J. W. Scott, Worcester...	Stud - button shank.
July 1,	4187	C. H. Thew, Whitchaven	Draw - spring for ships' cables.
„ 4,	4188	J. W. Mott, Lead Bridge Road	India - rubber tobacco pouch.
„ 7,	4189	J. Adams, King William Street	Tool for filling cartridges &c.
„ 18,	4190	J. Chesterton, Leicester...	Appendage to fire-arms.

PROVISIONAL REGISTRATIONS.

June 30,	1083	W. Press, Walburgh St.	Quick action drill-stock.
July 1,	1084	G. Kings, Tyburn, near Birmingham	Self - acting break.
„ 9,	1085	J. Chandler, Creek Foundry, Deptford	Glass water-gauge.
„ 12,	1086		
„ 14,	1087	T. E. Ladd, Walcot Place East, Walworth	Watch protector.
„ 16,	1018	J. Major, New Street Hill, Shoe Lane, E.C.	Economic gas-burner.
„ 18,	1089	C. Price, Mill Street, Wolverhampton	Lock.
„ 25,	1090	Brown & Clark, Richard Street, Birmingham	Cigar-holder.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

WIDENING RIVER, *Beckingham, Fenton*, &c.—For building new bridges and sluices, and repairing existing bridges, forming flood-banks, &c. Plans, &c., office of Mr. C. J. Neale, Mansfield. Tenders to August 11.

CHURCH, *East Markham, near Tuxford, Notts.*—Restoring and refitting. Drawings, &c., Rev. G. W. Bramelet, Vicarage, East Markham. Tenders to August 1st.

CORN MILL, *Leeds.*—For the engineers, millwrights, builders, joiners, and other workmen of a corn mill to be erected in Tenter-lane, Leeds. Apply to Messrs. Bevers and Wightman, Leeds.

POOR-LAW OFFICES, *Leeds.*—For the excavators', masons' work, bricklayers' work, carpenters and joiners' work, slaters' work, plumbers and glaziers' work, plasterers' work, iron-founders' work, and painters' work, requisite for building the new Poor Law Offices in East and South Parade. Plans, &c., and form of tender, on application to the Architect, 71 Albion-street, Leeds. Tenders to 12 o'clock, August 3.

POLICE STATION, *Crediton.*—For the erection of a Police Station and Petty Sessions room at Crediton. Plans, &c., at the office of Mr. Henry Ford, Clerk of the Peace, Castle of Exeter. Tenders to August 3.

SEWERING, PAVING, &c., *Manchester.*—For the sewering paving, &c., of Carter-street, from Julia-street to Carnarvon-street, New-street, from Julia-street to Frances-street, Melbourne-street (Julia-street). Plans and specifications, and blank forms of tender, on application to Mr. William Frances, the Surveyor, at the Town Hall. Tenders to August 26.

WORKHOUSE, *Scotland.*—For the erection of Galashiels Union Poor-House, at Galashiels. Plans, &c., Mr. Stalker, Writer, Galashiels; or of Mr. Walker, Architect, 53 Frederick-street, Edinburgh. Estimates for the whole, or portion; but the amount of each trade must be stated separately. Tenders Mr. Walker's offices August 3.

FARM HOUSE AND BUILDINGS, *Newent.*—On the Okle Clifford estate. Plans, &c., Mr. Washbourn, Solicitor, 12 Palace Yard, Gloucester, to August 5; where sealed tenders addressed to the Clerk and Solicitor of the Trustees of St. Kynlburgh, otherwise St. Kimbrose Hospital, Gloucester. Further particulars, Mr. J. C. Jackman, Surveyor, Gloucester. Tenders to the Chief Clerk of the Vice-Chancellor of the Court of Chancery.

QUAY WORK, *Scotland.*—To form a new margin for the river Clyde to stop further encroachment by water, and to form a new embankment to prevent the Holm Lands from being flooded. All on the farm of Mid Holm of Grange, in the parish of Pellihain. Plans, &c., Mr. R. Denholm, Factor, Carmichael, by Lanark; and Mr. Stodart, Hill Head, Covington. Estimates with Mr. Denholm, August 2.

SEWER, *Lambeth.*—For laying down, constructing, &c., 2,850 feet or thereabouts of brick sewer, in Paradise-road, Binfield-road, and Charlotte-street; and for the maintenance thereof in complete repair for 12 calendar months. Plans, &c., Mr. Hugh Macintosh, Surveyor of Sewers, Office of the Vestry, Kennington Green; to which place tenders before 4 o'clock on the afternoon of August 1.

SEWERS WORK, *St. Leonards, Shoreditch.*—For the supply of materials, and the execution of the day, jobbing, and measured works, for the sewers, drains, gullies, &c., in the parish, under the control of the Vestry from the 2nd day of August next, for a period to be determined. Forms and specifications 5s. each, with information, Mr. W. Y. Freebody, Chief Surveyor to the Vestry, 37 Hoxton-square, where tenders before 5, August 2.

SOUTH WALES COAL, *Navy.*—For Trincomalee, 2,500 tons, Bermuda 2,000, Jamaica 5,000, Barbadoes 600, and Halifax 500 tons. Tenders at Somerset Place by two o'clock, August 2, containing the names of two sureties in £1,600 for Trincomalee, £700 for Bermuda, £1,560 for Jamaica, and the name of one surety each in £200 for Barbadoes and Halifax. The attendance of a principal or agent indispensable. Particulars and form at Somerset Place.

TWISTED IRON SPIKES, *East India Railway.*—For 400 tons as per specification at the offices of the Company. Tenders, August 2, D. I. Noad, Secretary East India Railway House, Alderman's Walk.

PLANS AND ESTIMATES FOR NATIONAL SCHOOLS, *Sutton, near Ely.*—The school to be in the form of the letter L, and to comprise two rooms of equal dimensions, 40 feet long by 20 feet broad. Also a master's house attached. The whole, with the internal fittings of the school-rooms, to be in strict conformity with the paper of instructions to architects and builders furnished by the Committee of Council on Education. Application to see the site and paper of instructions, to Mr. Tubbs, Sutton; to whom plans and estimates, for the Committee, up to August 6. Any further information from the Secretary, Everard Calthorp, Esq., Sutton.

RAILWAY SERVANTS.—Station-masters, engine-drivers, stokers and guards, for the Cork and Youghal Railway. Applications in writing from experienced and qualified persons to be sent, accompanied by testimonials, by August 1, to O. C. Edwards, Esq., Engineer to the Company, St. Patrick's Hill, Cork. No personal application attended to. Offices of the Company, 176 Gresham House, Old Broad-street, London.

PRICES CURRENT OF METALS.

London, 29th July, 1859.

	£ s. d.	£ s. d.	Disc. p. cent
IRON, Rails in Wales and N. of England ..... pr. ton	6 0 0 to		nett
Welsh Bars, in Wales .. „	5 15 0 „	6 0 0	4
Staf. Bars at the Works „	7 0 0 „	7 10 0	2½
„ Hoops ..... „	8 0 0 „	8 10 0	"
„ Sheets, Singles .. „	8 10 0 „	9 0 0	"
„ Nail Rods ..... „	7 0 0 „	7 10 0	"
„ Boiler Plates .... „	8 10 0 „	9 0 0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow..... „	2 12 6 „	2 12 9	nett
Do. No. 1, Good Brands „	2 12 3 „	2 14 0	"
Scotch Bars ..... „	7 0 0 „	7 15 0	"
Swedish Bars, in London „	13 10 0 „	15 0 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 12		3
Tough Cake and Tile „ ton	107 10 0		"
Best Selected..... „	110 10 0		"
Australian ..... „	112 10 0		"
South American .... „	103 0 0 „	104 0 0	"
Yellow Metal Sheathing..... per lb.	0 0 10		"
STEEL, Swedish Keg ..... pr. ton	18 10 0 „	18 15 0	"
„ Faggot ..... „	20 10 0 „	20 15 0	2½
TIN, English, Block ..... pr. cwt.	6 18 0		"
„ Bar..... „	6 19 0		3½
Foreign, Banca ..... „	7 6 0		"
„ Straits..... „	7 0 0		nett
TINPLATES, Charcoal, I.C. ... pr. box	1 13 0 „	1 14 0	5
Coke, I.C. ..... „	1 7 0 „	1 9 0	"
LEAD, Pig, English ..... pr. ton	22 15 0 „	23 5 0	"
„ Spanish ..... „	22 0 0 „	22 10 0	2½
Sheet ..... „	23 15 0 „	24 10 0	"
SPELTER, on the spot ..... pr. ton	20 15 0 „	21 0 0	"
for arrival..... „	21 10 0 „	22 0 0	nett
ZINC, English, Sheet ..... „	25 10 0 „	26 0 0	"
QUICKSILVER ..... per btl.	7 0 0		1½
			1½

REMARKS.—Our Metal Market has been quiet during the week. Prices nearly unaltered.

LAWRIE AND HAGGER, Metal Brokers.

33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 5, 1859.

THE NEW COINAGE.

Now that an improvement of the inferior coinage of the realm is determined upon by the Government, and an especial act of Parliament legalises an issue of coins of mixed metal or bronze, we give in tabular form the weights and other particulars of the existing copper coins circulating in Great Britain and her dependencies, with a view to showing that in other points beside the artistic there is room for reform :—

Denomination of Coin.	No. of pieces in lb. avoir.	Wt. of each piece in grains.	Value of one lb.	Value of one ton. £
Pence	24	291·66	2s.	224
Half-pence	48	145·83	2s.	224
Farthings	96	72·91	2s.	224
Half-farthings ...	192	36·45	2s.	224
Obolis	240	29·16	2s.	224
⅓-Farthings.....	288	24·30	2s.	224
¼-Farthings.....	384	18·22	2s.	224

The first three denominations of coins, as is known to all, circulate at home, but the others are current in the Colonies, and more especially in Malta, the Ionian Islands, and Ceylon. Now it does seem clear that there would be room in a new home coinage for a considerable decrease in the weight of the penny, half-penny, and farthing tokens. There can be no good reason for compelling Her Majesty's lieges to carry about with them so many pounds weight of metal when coins of one-half the thickness might be made to represent precisely the same value. In gold and silver coinages we admit that there should be a relationship or identity of quantity and value in each piece, but in the case of copper or bronze there exists no such necessity. Already the pound weight of copper, which costs on the average one shilling, is coined into twenty-four pieces representing *two* shillings; and why not make the new penny one-third lighter, and regulate the other coins by it? Why not thus economise metal, and cover to a great extent the cost of the new coinage? These coins, as has been said, are mere tokens of value, and having the Mint engraving impressed upon them they would be quite as acceptable to the people as the massive discs of metal which now wear their pockets and their patience out. By such means, too, the miserable specimens of the circulating medium of which we complain could be got rid of entirely. They might be exchanged for the newly-Minted coins and then recoined at a profit! Having moved the powers that be to commence a desirable change, it is our wish to see that change effected in a complete and inexpensive manner; and hence our suggestion for reduction of weight.

With respect to the artistic character of the new issue of money, that should be especially regarded. Of course the head of Her Majesty must form the obverse in each case, but we submit that it would not be wrong to take as a model a portrait of the Queen as Her Majesty now appears—rather than to copy that which was taken at the commencement of her reign. It cannot be considered offensive to say that Victoria I. is older now than then, and a new coinage should at least tell the truth. More on this *head* we need not say. The reverse may represent the well-known allegorical Britannia, with such ornamental and appropriate accessories as the Mint artists might devise, whilst the present inscription could not perhaps be much improved.

It is particularly fortunate in respect to the forthcoming coinage of bronze, that Mr. Gladstone is in office. That gentleman has shown himself particularly clear-headed as regards the decimal system of weights, measures, and value, and is, as we believe, completely free from bias for or against that system. Moreover, Mr. Gladstone has been Master of the Mint in his day—sixteen years ago—and although the office was then a political one, and did not call for practical interference from him, he most likely gained some knowledge of the duties of the post. As Chancellor of the Exchequer he exercises by right much control over the great money factory, and his taste and judgment brought to bear upon the new issue of mixed metal coins may influence their character very materially. It is proper that the important first step now to be taken should be *carefully* taken, and that no opportunity be afforded hereafter for reflections or unfavourable criticism upon the new coinage. It will in all probability be fully a half century before so fair an opportunity again offers itself for remodelling the inferior metallic currency. How vitally important is it therefore that what is to be done now should be done well!

For ourselves, we are not quite certain that the public would not be gainers by inviting open competition among engravers generally for designs for the new pieces of money, and offering a price for the best. The engraving talent of the kingdom would thus be exhibited, and art and taste receive a yet further impetus. If, too, there is any chance in the future—and we think there is considerable—of an introduction of the decimal system of monies, the new bronze coins might be struck of such size and weight as to be readily made applicable to that system. It would not require any juggling to effect this, and Lord Overstone, with all his strong feelings on the subject, need not be chagrined to find that those in authority yet consider the decimalisation of the coinage of England a *possibility*. The Chancellor of the Exchequer need not be told how to have the new coinage managed, as regards weight, &c., so as to make it available for the existing duodecimal or the possibly-coming decimal plan.

With regard to our suggestion of competition in designs for the new coins, let it not be supposed that any slur is thereby intended to be thrown on the Mint engraver, whose name—Wyon—is known and respected the world over. Far is that from our intent. It is purely and only with a view to obtaining for our own native land a coinage superior in all respects to that of any other country, and which shall come as near to perfection as possible. On this ground we again urge the proposition upon the Government. The number of copper pieces supposed to be in circulation now in England and the Colonies amounts to five hundred millions, and as these must be supplanted by a larger number of better coins of bronze—how essential, we repeat, is it that there be no mistake in the first step to improvement?

It must be forgiven us if we appear pertinacious in our remarks upon coinage reform, but since the agitation for it began in our columns, and through our columns has been pursued to success, we think that we have earned the right to have a voice in the conduct of that reform to a beneficial issue. Few are there, it may be trusted, who will be disposed to deny us this privilege.

THE GOVERNMENT DOCKYARD COMMITTEE.

A MEMBER of the House of Commons—a gentleman utterly unversed, we presume, in public affairs—lately expressed his anxiety to see the Report of the Committee on Dockyard Economy appointed a year ago by the late Admiralty. That there should here and there exist an individual simple enough to attach importance to the conclusions of such a Committee is not surprising, because people capable of any folly are always to be found. But, for our part, we have always looked upon this Dockyard Economy Committee, constituted as it was, as a piece of elaborate and costly absurdity. Now that the Report issued by its members has fallen prematurely into our hands—no matter how—our opinion of its authors is most completely established.*

Let us look first at the nature of the subjects investigated by this Committee. They comprise (to state them roughly as they stand in the official "Recapitulation" given on another page) the cost of the work done in the Dockyards, the appointment of officers for supervising it, the entry of men for performing it, the superannuation system, the modes of paying for work of all kinds, the training of shipwright officers of all grades, the education of apprentices and naval architects, the behaviour and promotion of clerks, the purchase of materials, the issuing of contracts, the management of the factories, and many other kindred topics. Now, the appointment by the Lords of the Admiralty of a Committee to investigate large and weighty subjects of this kind is a very serious matter; and such a Committee should comprise numerous experienced mechanical officers and accountants, in order to guard effectually against the preponderance of everything like personal bias, or the whims of individuals. This must, we think, be apparent to every one. If the whole of the manufacturing establishments in connection with the Navy are to be examined, and sentenced either to dissolution or change, the judges ought undoubtedly to comprise a goodly number of men distinguished for their ability and independence.

Bearing these considerations in mind we turn to the Committee before us; and what do we find? This: that it consists of five persons only, viz., an Admiral, a Master Shipwright, a Chief Engineer, a Storekeeper, and an individual who does not exactly know what he is, and, therefore, calls himself sometimes "Consulting Engineer," sometimes "Civil Engineer," and sometimes "Shipbuilder"—being about as much one of these as the other, we presume. Admiral Smart is the admiral, Mr. Chatfield is the master shipwright, Mr. Murray the engineer, Mr. Laws the storekeeper, and Mr. Bowman the gentleman who is doubtful of his vocation. This is the general aspect of the Committee. If we approach it more closely, and keep the Report before us, we find that the nominal number of five has been reduced to four by the voluntary withdrawal of the only member who is favourably known to the public, and who by

* As Mr. William Schaw Lindsay (once the Liberal member for Tynemouth, now the Tory member for Sunderland) will be very likely to ask the Secretary of the Admiralty in the House of Commons to state how we became possessed of the Report in question, we may as well say that we have had opportunities of seeing the said Report afforded us in several quarters, and by gentlemen whose sole interest in it arises from curiosity, copies of the Report having been sent, as Mr. Murray knows very well, to the Dockyards. We are not indebted to any one at the Admiralty, nor are we to any one concerned in the Committee, for what we have obtained. We think it desirable to state this, because as Mr. Lindsay is generally so ready to put in the House of Commons any question which the Government of the day may think it convenient to answer, it is very likely he may now wish to put one on his own account, particularly as his friend, Mr. Bowman, has made so annoying a display of himself in the matter of the Dockyard Committee.

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education and authorship has a claim upon our confidence. We allude, of course, to Mr. Chatfield, who not only refuses to sign the Report of his colleagues, but puts forth very cogent reasons for dissenting from almost every important conclusion they have come to. They think the "morning meetings" of the principal officers have become mere forms; Mr. Chatfield says they have not. They think the smitheries should be under the control of the Chief Engineer; he thinks quite the contrary. They say the Cossack was a cheap vessel; he says £9,368, were expended in four years upon her after her so-called completion. They recommend "day pay" with "proper supervision" instead of the "task and job" and other systems; he considers that to talk of "proper supervision" is to beg the question. They think the system of shipbuilding pursued in private yards should be imitated in the Royal Dockyards; he says, "so far from imitating the system of private yards, we should take great care to avoid it." They deem the resort to varieties of day pay advisable; he deems it "very unadvised to attempt to reintroduce a system which has been tried and failed." They advise the substitution of deferred annuities for the workmen's present superannuation; he wholly disapproves of such a change. They urge the return to leading men and quartermen; he "strongly advises not returning to a system inferior," in his opinion, "to the present." They also urge the removal of inspectors, and a consequent decrease in the amount of supervision exercised over the workmen; he states "it would not be advisable to reduce the amount of supervision," which he considers "to be already at its minimum." They suggest certain changes in the position of draughtsmen; he calls their proposals suggestions, the object of which he "cannot "understand." They propose a reduction in the salaries of foremen; he "should not re- "commend it." They would adopt a modification of the timber inspectors' position; he deems their plan "the reverse of any change "that might be considered expedient." Finally, they desire to introduce a peculiar class of superior pupils; he says, "if the plan proposed "by the majority of the Committee were "adopted .... my conviction is, that such a "step would prove a total failure." We cannot compliment Mr. Chatfield upon the course he has taken in this matter, because as a sensible and educated shipbuilding officer, free from malevolence and party feeling, he could not for a moment have thought of committing himself to the vagaries of his associates. We may, however, and hereby do, tender him our thanks for taking the trouble to convict them of much absurdity. His withdrawal leaves us a Committee of four only.

We shall do no violence, we presume, to any one's sense of right if we next remove from this reduced Committee their gallant chairman, Admiral Smart. We need say but exceedingly little in defence of his removal; for he must be an exceedingly smart Admiral indeed who, from a little superficial acquaintance with establishments like our Dockyards, could derive the right to have a voice even in the subversion or transformation of those huge manufacturing establishments.

Thus our Committee has dwindled down to three. May we let the trio remain? Tell us, Mr. Bowman, may we? Alas! poor man, we believe he cannot answer, Yes! We know Mr. Murray and we know Mr. Laws; and we greatly fear from Mr. Bowman's autobiography (published in the MECHANICS' MAGAZINE for June 24, pp. 410—411) that he is not the man to set up an opinion of his own, if he should happen to have one, against two such opponents, however much he might desire to do so. We shall be pardoned, we hope, if we venture to glance a moment at the position of this Mr. Bowman. In an article published towards the end of April last we happened to mention this gentleman as "one of Mr. Lindsay's foremen." This hurt the pride of our Admiralty Committeeman, and he hastened to protest against the imputation. In doing this he incidentally told us both what he is and what he has been. This is what he says of himself:—In 1824 he obtained a patent for a chain cable stopper; he was then manager of Messrs. Simson and Co.'s engine works at Aberdeen. In 1838 he started a firm, Bowman, Vernon, and Co., "engineers "and iron shipbuilders." He next "left that "firm and went into Staffordshire"—the "firm" turning out a bad speculation, we presume. In July and August, 1847, he contributed some remarks on cast iron to the MECHANICS' MAGAZINE. He next "joined the firm" of G. B. Thorneycroft and Co. as "superintending engineer," and on June 8th, 1850, Mr. Thorneycroft mentioned him favourably in the *Mining Journal*. Finally, in 1853, he "left that firm," and commenced his practice of consulting engineer. This wandering gentleman, who has made his way into so many "firms" and stopped in so few, and who, even when he was the head of his own firm, did not give satisfaction apparently —this gentleman modestly tells us that he should not wish that either our mind or that of the public "should have the impression that one of the "members of the late Dockyard Committee "*was only a foreman of Mr. Lindsay's.*" And yet in the very same letter he tells us that "he "did superintend the construction of five steam- "ships for Mr. Lindsay," and adds that he no doubt owes his appointment on that committee "principally to that gentleman." So that this high-mettled Committee-man, who would object to being *employed* as a foreman by Mr. Lindsay, thinks it no disgrace to be *patronized* and pushed into office by him! The character of this person must be borne in mind hereafter, for as we shall show in future articles, his three colleagues and he have the effrontery to tell us how *gentlemen* should be trained for high positions, and to warn us against giving too many opportunities of rising in the world to the sons of working men.

We have thus seen that Mr. Chatfield is too sensible, that Admiral Smart is too uninformed, and that Mr. Bowman is too puerile, to be held responsible for this Report. The Committee is, therefore, reduced to two members. Of these Mr. Laws is a storekeeper, and before he became storekeeper was a clerk. It can hardly be expected, therefore, that he would be very dogmatical in deciding the purely professional questions of the shipwright and the engineer; more particularly as certain crochets in connection with the keeping of accounts form his peculiar hobby. If Mr. Murray would yield to him on these points, he would unquestionably yield to Mr. Murray on others.

Thus, by simply opening our eyes, and looking these Committee-men in the face, so to speak, we have discovered that Mr. Andrew Murray, Chief Engineer of Her Majesty's Dockyard, Portsmouth, is the man, and the only man, who has really put forth (in so far as manufacturing processes are concerned) the striking Report before us. He it is who has undertaken to settle (or rather unsettle) of himself the whole shipbuilding and engineering establishments of the Government Dockyards. Now, that Mr. Murray deems himself fully competent to execute the task which has thus devolved upon him, we do not for a moment doubt. He has before tried to make a little knowledge go a long way, and there is no reason why he should not do so again. If we are rightly informed, he lately undertook the revision, not to say the composition, of a treatise on naval architecture; his plea probably being that he studied shipbuilding under Mr. Fairbairn! He is not, therefore, a man to shrink from large undertakings from any excessive sense of modesty. There is, however, one consideration which, one would have thought, might have weighed with him, viz., that Sir Baldwin Walker, whose management of the navy is deeply involved in the Report before us, is both a gentleman and Mr. Murray's superior officer. We do not for a moment say this should have made him in the slightest degree unfaithful to his convictions (although it ought, perhaps, to have kept him out of the Committee altogether), but it should have had a moderating effect upon his prejudices, and kept his proposals within bounds. But we waste words on this point if it be true, as some think, that Mr. Murray is not only a warm partizan of the late Admiralty, but a special instrument in the hands of Mr. Corry, the late Secretary to the Admiralty. If this be so, we need not be surprised at even the extremes of folly which are embodied in this Report. There is, however, another consideration which, although it has not occurred to Mr. Murray, has struck many persons, and that is, the absence of all grounds for public confidence in his opinions. What has Mr. Murray ever done to gain the respect, or even the attention, of public men? Will any reader tell us? As he has not scrupled to deliver himself of opinions upon shipbuilding matters wholly adverse to the master shipwright associated with him, we have a right to ask what he knows of the shipwrights' trade, or of the naval architects' profession. Has he ever built a ship? Has he ever designed one? If he has, did she float upright? And if she did, how much "brick" ballast was necessary to keep her so? There are old acquaintances of Mr. Murray who would like to see these questions answered. But, to say no more of the shipbuilder's business, what has Mr. Murray done to distinguish himself as an engineer even? He has gained a good position at Portsmouth, it is true, but that is no proof of professional eminence. When he got that appointment, partizanship was more regarded than ability, and at that time many a man who was never suspected of being skilful in his profession climbed high. His promotion of itself, therefore, affords no mark of ability. Where, then, are his proofs of eminence? Many an echo will, we are confident, answer "Where?"

The utter unfitness of this Committee for its work, and the foolishness which prompted its appointment, are abundantly evinced in the result of its deliberations. Its sittings have been prolonged for a year, and the expense occasioned by it will be reckoned by thousands of pounds sterling. And what is the fruit of all this? A Report which no Government would dare to act upon, except, perhaps, in some few minor matters. Mr. Chatfield's honourable and necessary dissent has, of course, rendered it utterly worthless, in so far as all the great questions of economy discussed in it are concerned. The present Admiralty—and the late Admiralty also—know as well as we do that it is everywhere esteemed as little more than Mr. Murray's manifesto against the present management of the Dockyards, coupled with a daring and monstrous attempt of his to fling as many as possible of the shipbuilding departments of the navy under the feet of the chief engineers. The Admiralty also know perfectly well that any attempt to give effect in the Dockyards to the devices and desires of Mr. Murray's heart, would arouse so strong a sense of injustice

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and excite such wide-spread hostility, that failure would inevitably ensue.

We cannot now enter upon a discussion of the details of this Report. There are many, very many, features of it which we shall have to consider hereafter. All that we can at present add is that we shall, in a future article or articles, adduce from it stronger examples of ignorance and absurdity—not unaccompanied by what we can only call snobbishness—than have ever before astonished our eyes in any official report whatever.

THE DECIMAL SYSTEM OF MEASUREMENT.

At the general meeting of the Institution of Mechanical Engineers held in Birmingham on the 27th ult., Mr. John Fernie, of Derby, a gentleman of distinguished merit as an engineer, read a very encouraging paper on the application of the decimal system of measurement to mechanical engineering work—a paper deserving all the prominence which we can afford it. The subject has been brought forward at previous meetings of the Institution by Mr. Whitworth, who proposed the inch as the standard of length for mechanical engineering work and metal manufacturing purposes generally, the inch being subdivided decimally into 1,000 parts. The application of this system has been already commenced in the locomotive shops of the Midland Railway, at Derby, in which Mr. Fernie labours professionally, and he is satisfied from the experience already gained of its working that its general adoption would be attended with much less real difficulty than might appear at first probable, without involving any objectionable changes. By taking the inch as the standard of length, all difficulty attending the adoption of a new standard is avoided; for many dimensions common in mechanical engineering work are already expressed in inches, and the inch is the unit of measurement in culculations of steam pressure, strength of sections, &c.; while even in larger dimensions, as in bridge girders, &c., no more figures are required in most cases for expressing the dimensions in inches alone than in feet and inches. With respect to the metre, adopted as the standard of length in France, the extreme difficulty of its introduction in this country would amount to an indefinite postponement of the whole question, if it did not render it absolutely impracticable; and the inch has an advantage as a standard in the present case from its decimal subdivision affording a finer division for line measure than is obtained by the decimal subdivision of the metre, and with one place of decimals less. With the metre the smallest dimension of line measure is the millimetre, ·001 metre, or one-thousandth of a metre, requiring three places of decimals, and equivalent to about ·04 inch; whereas with the inch the smallest dimension of line measure is ·01 inch, or one-hundredth of an inch, requiring only two places of decimals, while it is only about one quarter the length of the millimetre. The inch is moreover in effect the present legal standard in this country, the yard or parliamentary standard being fixed at 36 inches, of which the seconds' pendulum is 39·14 nearly.

An important step has been already effected in carrying out the decimal system, by the decimal wire gauge introduced by Mr. Whitworth, in which no alteration is made in the sizes ordinarily used, the names only being changed to one uniform series representing the exact value of each size in thousandths of an inch. Thus in the ordinary or Birmingham wire gauge the No. 20 conveys no idea of the size it is intended to denote, and the same size is represented by a different and unconnected number in each of the five different gauges now in use, being No. 62 in the Lancashire wire gauge, No. 13 in the metal or plate gauge, No. 18 in the music wire gauge, and No. 3 in the needle wire gauge. But in the new decimal wire gauge all these different numbers are replaced by one No. 36, the actual size being ·036 inch, or 36 thousandths of an inch, thus denoting the exact size that it represents.

In order to obtain the degree of accuracy required in an engineering workshop, where the one-thousandth of an inch is distinctly appreciable by the workman in making the fitting parts of machinery, a measuring machine has been constructed by Mr. Fernie, on a similar principle to the delicate measuring machine invented by Mr. Whitworth, in which a screw is advanced very slowly by means of a large wheel having a graduated rim, and the required length is measured by end or contact measurement instead of line measurement. This machine affords the means of supplying exact standards of size for all portions of engines or other machinery, whereby perfect accuracy of fit can be ensured, and the exact amount of clearance or exact degree of tightness required is obtained, while the original standards can be at any time repeated or verified.

We may mention in this connection a very admirable instrument, the invention of Mr. James Cocker, of Liverpool, which was lately submitted to us for inspection. This consisted of a disc with a spiral or eccentric circumference, the successive points of which were, of course, at increasing distances from the centre. At the centre an arm is loosely pinned, and this arm carries a pin, which, as the arm is moved round, gradually approaches to or recedes from the circumference of the disc. By varying the form of that circumference any degree of measuring sensitiveness may be obtained. The instrument which we saw (and which was from two to three inches in diameter) readily detected differences as small as one-thousandth of an inch; it therefore showed very sensible differences in the size of hairs taken from the heads of different persons, or from the crown and beard of the same person.*

For the coarser measurements in the workshop the common rules now in use are replaced by decimal rules, twenty or thirty inches long, jointed for convenience at every ten inches, each inch being divided into tenths, and between each tenth a small dot or short mark is made, representing half a tenth of an inch; the workman is then soon able to subdivide this again by eye, so as to measure to two-hundredths or even one-hundredth of an inch, and one-tenth of an inch upon the rule is divided into hundredths of an inch for reference. These decimal twenty-inch rules have been already adopted by Mr. Whitworth throughout his works, and no difficulty is experienced in the change. In figuring drawings, the only alteration to be made consists in writing all dimensions in inches and decimals alone, which has the advantage of preventing mistakes in reading off or adding up dimensions; writing the figures with two places of decimals, even where the second place is 0, as in the case of 1·50 inch, for the sake of simplicity and accuracy in adding up dimensions; and drawings should be made as far as possible to a decimal scale, such as one-tenth, or one-fifth of the full size. The principle of the decimal system has been also adopted for weights and measures by the recent introduction of the "cental" of 100 lbs. for weighing corn, flour, &c., in place of the clumsy bushel, the weight of which is different in different localities.

* Since the above was written we have observed, in the Report of the Birmingham meeting (at which we were not present) that this instrument was exhibited on the occasion. It is thus described:—"A decimal measuring instrument was shown by Mr. James Cocker, of Liverpool, for measuring small sizes to one-thousandth of an inch, consisting of a flat graduated disc, the edge of which is formed in a spiral shape, with an abutment placed at a definite distance from the centre of the disc; to obtain any dimension the disc is turned round into the proper position, and the space between the spiral and the abutment gives the dimension required." Another small measuring instrument was also shown by Mr. Alfred Knight, of Birmingham, in which small dimensions are indicated to one-thousandth of an inch by an index upon a graduated dial, the indication being magnified by means of a rack and pinion.

SUBMARINE TELEGRAPH CABLES.

One thing we have a perfect right to demand of the gentlemen who next undertake to lay down a long and costly telegraph cable, and that is, a careful testing of the cable itself before it leaves the manufactory. Had this precaution been taken with the whole of the Atlantic cable the bells would not have been rung, the Bible quoted, and gold medals distributed in vain.

Our attention has been specially directed to this matter by the performance of some experiments which we lately witnessed at the works of Messrs. Reid and Co., the telegraph engineers of University-street, London. These gentlemen are not content with simply submerging the cable, nor even with subjecting it while submerged to considerable pressure; but they think it necessary to first exhaust the air from the vessel containing the cable, and then force in water until a pressure of about 200 lbs. per square inch is attained. For this purpose they employ a vessel strong enough to resist the pressure of the atmosphere when exhausted, and also the hydrostatic pressure to which the cable is intended to be subjected. This vessel is made with a cover, to allow of a coil of insulated wire being introduced and inclosed therein. One end of the covered wire is conducted from the interior, through a stuffing box, to the outside of the vessel; the other end of the wire is coated over and well insulated. The vessel containing the wire is then exhausted of air, and a vacuum formed by means of air pumps. The stop cock of the air pumps is then shut, and the passage for water is opened in order to fill the vessel; or a quantity of water may be introduced into the vessel, so as to fill or nearly fill it, before exhausting the air. One end of the wire of a galvanometer is connected with the outer end of the wire which has been brought through the vessel. Pressure is next exerted by pumping water into the vessel, and then, on connecting the two poles of the battery with the galvanometer and the water in the vessel respectively, if the insulation be perfect, no action takes place in regard to the needle of the galvanometer, no complete electric current being formed; but if there is any defect in the coating of the wire, however small it may be, it is indicated by the deflection of the needle of the galvanometer, which shows that a circuit has been formed by the water in the vessel getting in contact with some part of the wire which is being tested. It is recommended by Mr. W. Reid, the patentee of the process, that the exhaustion should be as perfect as possible, and that the pressure to which the coated wire is thus subjected should for submarine telegraphs exceed the pressure which the depth of water in which it is to be submerged can ever offer to such wire. For subterranean and similar electric telegraphs a few pounds on the square inch will suffice; but as excess of pressure over that to which it is likely to be subjected when laid down does not injure the wire, or cost much, while at the same time it more certainly insures detection of defects, or what are likely to become defects, it is

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recommended that the pressure even for these should be at least 20 lbs. on the square inch.

The process above described needs but little to recommend it. Properly carried out it is certain to reveal any fault that may occur in the manufacture, and thus guard us against laying down a cable until it is found to be perfect. With the best modes of constructing cables we cannot avoid the risk of some defect or other, and it is surely incumbent upon us to detect such defects as may exist before the repair of them is put beyond our power.

MARINE BOILERS FOR THE ADMIRALTY.

WE have already said* that Mr. Nasmyth and his colleagues of the Admiralty Committee on steam machinery decided contrary to the experience of abler men than themselves when they pronounced an opinion adverse to the merits of the Sheerness steam boiler patented by Admiral Tucker and Mr. Blaxland. These gentlemen—the one the Superintendent and the other the Chief Engineer of one of Her Majesty's Dockyards—observing the grave defects of the tubular boilers of H. M. gunboats and other vessels, did precisely what good and efficient servants of the Crown should have done, viz., suggested a remedy for the evils before their eyes. They invented a boiler without tubes, of cheap construction, and altogether free from the well-known defects of the gunboat boilers. To the merits of their invention we have already borne strong testimony, but the apathy of some and the hostility of others are preventing its adoption. The sapient Committee above referred to, of whose abilities we long since had astounding evidence, dismissed its consideration with a rapid sentence or two "signifying nothing."

Admiral Tucker, however, is an officer of some spirit and patriotism, and refuses to accept their decision without comment. He has accordingly drawn up a paper bravely entitled "Observations on part of a Report by the Committee for investigating the Steam Navy; contradicting its statements, and questioning its fairness;" to which paper we would draw attention. "It appears at page 36 of the report," says the author, "that a boiler, of which I am 'the patentee, was submitted to the Committee's attention; and had the report of the result of the trial of that boiler, as was but fair, 'and as had been promised, and given by the '"preceding Board of Admiralty, been submitted "to me before printed, the errors in it, to which "I shall hereafter advert, might have been, if "not avoided, certainly pointed out. But as that, "nothing more than the fair course of proceed-"ing, was not in good faith, nor even in "courtesy accorded, I resort to this method of "making known, first,—How it happened that "the boiler was tried in Sheerness-yard, of "which I had been the Superintendent; and, "secondly,—What the proceedings and facts of "the trials in reality were; and I shall venture "to suggest, why the expenditure of so compa-"ratively small a sum as £300 should not deter "a Board of Admiralty from irrefutably testing "the merits of a boiler which eminent and "practical men have considered to be superior "to the multi-tubular boiler by a saving of 20 "per cent. in first cost, more than 23 per cent. "in fuel, a greater production by 30 per cent. "of steam, besides being by very far the more "durable, and the less liable to repair."

Admiral Tucker next tells us that as Captain Superintendent of a naval yard during the late war, he became painfully aware of the constant breaking down and necessary repairs of our gunboats. Their defects, and the question of making good their repairs by the appointed time, being constantly before him, caused him great anxiety. His reflections, coupled with those of Mr. Blaxland, gave rise to the patent boiler, which, as the projectors believe, fully answered their expectation; and when the result was made known to the Admiralty, an inspection of the model was directed, and subsequently the application of the invention to a boiler of one of the gunboats, and a trial of the patented boilers in comparison with a multi-tubular boiler to be made in Sheerness-yard. To the trials, which were conducted by Mr. Langley of the Sheerness Steam Ordinary, the Steam Committee allude. But it is against the partiality with which these trials were made—Admiral Tucker being himself at that time abroad—that he has frequently complained to the Admiralty. "As, for instance, that all the leakage "of the multi-tubular boiler, and all its priming "were registered in favour of that boiler as for "steam which it had generated; for, indeed, to "produce a fictitious report of the desired eva-"poration, its fires were so urged as to blow off "heated cinders, which without doubt would "have set fire to any ship had it been afloat, "and was considered so dangerous to the dock-"yard as to compel the Superintendent's inter-"ference, who ordered the fires to be drawn." Again, notwithstanding that the issue of the comparative merits of the two boilers was,—which could work the longest without the loss of power?—the steaming of the multi-tubular could only be continued for a few hours at its full duty, from the constant choking of its lower tubes, and from its making a deposit of live cinders in the smoke box, causing its destruction during the trial by its own fire.

This mode of proceeding being, as Admiral Tucker says, neither satisfactory nor just, he obtained from the Admiralty an order for a trial of 144 consecutive hours. "The patent "boiler worked through the period without one "single interruption, while the multi-tubular "broke down five times, nor ever collectively "steamed through the appointed time." This trial having proved that the patent boiler could steam certainly for 144 consecutive hours, while the multi-tubular fell so far short, it was to be inferred that the invention had at least some merit worthy the attention of the Steam Department of the Admiralty, and the more so, because the patent boiler could be so much more economically constructed, and that the novelty could be applied to the boilers already afloat at a much less expense than repairing them with tubes. "So far as I have heard," says Admiral Tucker, "nothing of the kind has been yet attempted by the Steam Department."

However, on the 28th of June, 1858, he was ordered to put himself in communication with the Steam Committee, that the boiler might be tried: and he next proceeds to show that so far from fairly testing its merits, it was the members of the Steam Committee themselves who prevented a fair trial being made on that occasion. Early in the month of June, 1858, (and not the last day in August, the day of inspection, as would seem by the Committee's report) before the patent boiler was taken in hand, in preparation for the Steam Committee, he (Admiral Tucker) had applied to the Vice-Admiral W. F. Martin at the Admiralty to have a second furnace inserted in the patent boiler to increase its heating power. That request was made on his own responsibility to show the proper working of the patent in the size boiler then under trial. It was forwarded by Admiral Martin to the Committee before the boiler went into the workshop, notwithstanding which, and that the insertion of the furnace was requested of the Committee in order to ensure a full trial (which the Committee itself admits in page 37 of their Report),* the Committee, who could so clearly see the advantage, refused the request, alleging as a reason, *they* would "not take the responsibility "of an alteration." "As if the responsibility "of the result of the addition was not "mine, instead of theirs!" says the Admiral. By that refusal a fair trial was of course altogether prevented, nor can the Committee justify their having reported that "the patent boiler "was in heating power 25 per cent. under the "multi-tubular," after having refused to the former that which they admit would have proportionably increased its heating power, thereby preventing such a boiler as the patentees intended for competition from being tried at all. The permission refused to the inventors of the new boiler was such as is daily accorded to other inventors.

Again, to a second application for another furnace being inserted, the Committee say in their letter to Admiral Tucker of the 12th of July, 1858: "The Committee, without "giving any decided opinion how far it is pos-"sible to introduce another furnace, as you now "propose, into such a small boiler, must decline "to make any request grounded upon your "proposed alteration. But they will be most "happy to witness any trial and give their un-"biassed opinion, when they go to Sheerness, "upon any boiler constructed under your direc-"tion, that they may find ready for inspection "and use." "A very proper promise of fair "conduct after having done me all the injury "they could. The only question is,—Did the "Committee keep their promise?" remarks the Admiral.

The size of the boiler under trial, into which the patentees desired to insert two furnaces, was large enough to have admitted two of fifteen inches in diameter. In order, therefore, to show that they had not made an ill-considered application, the patentees caused a new boiler of four feet long and one foot in diameter to be prepared, and into that boiler two furnaces were introduced of only four inches in diameter. This boiler was shown the Committee with steam up to 30 lb. pressure, but to give an unbiassed opinion, or any opinion at all about it, the Committee altogether omitted. In perfect keeping with that omission, the Committee, although they allude in their report to certain trials which they did not see, are altogether silent on the trial of 144 hours, during which the patent boiler steamed uninterruptedly, while the multi-tubular so often broke down.

The Committee further report of the patent boiler, "it yet required forty-eight minutes "more time to raise steam than in the ordinary "boiler." The truth of the following table Admiral Tucker offers to prove by undeniable evidence. The trial took place September 1st, 1858.

		H. M.	lbs.	H. M.	H. M.
Patent Boiler	Lit fire at	5 25,	Steam up to 74 at	6 40 =	1 15
Multi-tubular Boiler	ditto	9 50,	ditto	ditto 10 57 =	1 7

The foregoing figures speak for themselves, and they prove the Report of the Committee widely at variance from the truth. The time required to get up steam by the patent boiler (prevented, be it remembered, by the Committee from making its best efforts) did not exceed that required by the multi-tubular by 48 minutes, but only by 8, while it is certain that the trial then made of only three hours, congenial enough to a tube-choking boiler, was in reality utterly insignificant as a test of the best boiler for the

* MECHANICS' MAGAZINE for May 20, 1859, No. 21, New Series.

* That as both the grate and heating surfaces would by that means be increased, the power of the boiler to supply steam would be proportionably increased.

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Navy. "It will be asked," says Admiral Tucker, "Have I made the Admiralty acquainted with "these proceedings of the Committee, and have "I challenged investigation? I have. It has "not yet been awarded." Were the Report of the Steam Committee only a statement, signed as nothing more than the opinion of the individuals whose names appear, the document would be altogether unimportant, but "An "Official Committee" is clothed, as Admiral Tucker says, with so much consequence that their doings should not only be investigated, but exposed; for a decision affecting the interests of an individual being confided to their judgment, it behoves the Committee to be scrupulously fair and just, "and if it be of any— "and who will deny that it is of the greatest— "importance to our Steam Navy, that it shall "be supplied with the best boiler, which in the "progress of science may from time to time be "produced, it is imperatively necessary that in "examination of comparative merits, the com- "petitions and the reports be complete and "impartial."

We need not add to these remarks. They show clearly enough, not only that the Steam Machinery Committee appointed by the late Admiralty were a miserably incompetent set of gentlemen, but also that there yet exists at Whitehall an obstructive power of some kind which even the Superintendents and other chief officers of our Dockyards cannot quite break through. Is it too much to ask for a fair and open settlement of this boiler question, which involves financial considerations of great moment to the country?

THE CASE OF HENRY CORT, AND HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

No. VII.

The naval authorities appear by the correspondence to have prosecuted the inquiry as to the success of Cort's invention with becoming zeal. On the 1st of March, 1784, the following order was issued:—

"Navy Office, 1st March, 1784.

"Gentlemen,—These are to direct and require you to demand from Messrs. Cort and Jellicoe such a number of links and shackles from mooring chains made of neutral iron, according to their own process of working the iron, for an experiment against a like number prepared of the best iron, and to make a trial and report the result of the strength of that made from neutral iron compared with the other. You are to supply them with neutral iron for it if they are in want thereof; for which this shall be your warrant.

(Signed) "C. Middleton,
J. Henslow,
E. Hunt,
G. Marsh.

"To the respective officers of Portsmouth Yard."

The following portion is all that has been preserved of the reply to that order:—

"Portsmouth Yard, 1st June, 1784.

"Honourable Sirs,—In obedience to your directions of the 1st of March last, to demand from Messrs. Cort and Jellicoe a number of links and shackles for mooring chains made of neutral iron, according to their new process of working the iron, for an experiment against the like number prepared from the best iron in our smithery—

"We are humbly to acquaint you that we have made the experiments of the links and shackles on two anvils, and letting the large hammer of four cwts. which shuts the arms of anchors fall the height of sixteen feet on the centre of the links and shackles between the anvils"—

In 1787 was published "A Brief State of Facts relative to the New Method of making Bar Iron with Raw Pit Coal and Grooved Rollers. Discovered and brought to Perfection by Mr. Henry Cort," containing the particulars and results of the experiments on Cort's iron at the dockyards.

The following extracts will be read with much interest:—

"Mr. Cort's process of refining iron from the pig or cast state, in a reverberatory furnace, heated by common coal or any other fuel, has the effect of separating from the metallic particles certain impurities which are not discharged in the common methods of rendering iron malleable; and thereby a manifest difference of quality is occasioned in favour of the furnace iron; which quality is further improved by the mode, also invented by Mr. Cort, and used in manufacturing the iron, when malleable, into bars, and even into bolts, and many uses, by rolling it in a welding heat through rollers with grooves accurately formed, instead of working it under hammers. This iron has a peculiar appearance in its grain, but it is nevertheless so effectually disentangled from impure scoriæ, and the texture of it is so uniformly perfect, that it may be pronounced superior, upon the whole, for body, strength, and toughness even to the best of Swedish Orgrounds iron. Mr. Cort manufactured about thirty tons of this iron under the inspection of two Master Smiths belonging to the King's dockyards, from old ship ballast delivered to him out of the dockyard at Portsmouth for that purpose. The bar iron so made by Mr. Cort was afterwards distributed to all the Royal dockyards, and being there wrought into anchors and other naval implements, underwent a series of experiments against the like instruments wrought from the best Orgrounds iron, the marks of which were P L and crown, double bullet, hoop, and L, whereby its qualities were put to the severest test."

The particulars and result of these experiments are as follows:—

RESULTS OF THE EXPERIMENTS AT PORTSMOUTH.

"An anchor of 67 cwts. 2 qrs. 14 lbs., manufactured from Mr. Cort's iron, and tried in the usual way, was found equal to an anchor of the like size made of Swedish Orground iron.

"And P and eye-bolts for ships' caps, tackle-hooks, and hinges for doors, also made of this iron, and top-tackle and snatch-blocks bound with it were equal to the like articles made of the first sort of Orgrounds iron."

EXPERIMENTS MADE AT DEPTFORD DOCKYARD.

"Mr. Cort's anchor was manifestly superior; the part which broke had been injured by some accident in the heating to such a degree as to break short off with little or no strain, and the injury was visible upon inspecting the broken part; but in the second experiment with the arm which had not been so burnt, the anchor opposed to it was torn asunder in a part which had been extremely well manufactured, and where there was no appearance of imperfection or of the iron having suffered the smallest injury, but very much the reverse appeared upon a minute inspection.

"The experiments upon the hooks and strappings of bolts, and upon the hooks, eleven in number, were also favourable to Mr. Cort's iron. Six of the articles made of the Swedish iron appear to have been straightened, and only three of those made from his; and two of these three not to the same degree as the Swedish. Three of his indeed broke, and but one of the Swedish. None of either sort, however, gave way till after they had stood a much greater strain than ever is, or can be, put upon implements of the same kind in real use; and four only of the Swedish iron, but five of Mr. Cort's remained perfect after those against which they were respectively tried gave out. It was one of these five, the hook of a double top swivel block, that stood against one of the same dimensions made of the Swedish iron, which broke, they being equally drawn against each other from opposite capstans, with thirty men heaving at each, a purchase before which both sorts of iron had yielded in the immediately preceding experiment.

"Two eye-bolts of each sort of iron appear to have driven equally well, and two P bolts of Mr. Cort's also drove without injury: but of two perfectly similar made from the Swedish, although both drove, one broke in the stump.

"Upon the whole, it is presumed not too much to assert that in this course of experiments, Mr. Cort's iron was proved to be in every respect equal, at least in quality and substantiality, with the Swedish iron."

EXPERIMENTS MADE AT WOOLWICH DOCKYARD.

"Mr. Cort's anchor was indubitably the strongest; and it may be observed, that although this anchor was the heaviest of the two, yet that was owing to the largeness of the palms, for the shanks and arms were considerably less in circumference throughout than those of the anchor made from the Swedish iron, as appeared by measures taken at a great number of proportionate distances.

"And upon the whole of the trials made here, Mr. Cort's iron appears to have stood completely in five instances, the Orgrounds only in one; his gave way partially in three, the other in four instances; and although that broke also in four cases, his broke only in one. His, therefore, by the comparison of these particular instances may be pronounced superior in strength to the first sort of Orgrounds iron; and workmen in general who have tried it, declare that it is at least equal in all respects, especially that it is rather more malleable, retains its heat longer, welds, and bears punching, turning, and being wrought in the most severe manner to the full well."

EXPERIMENTS MADE AT SHEERNESS DOCKYARD.

"Mr. Cort's anchor was the strongest; and of the rest of the articles, two of his stood and two broke; three of the Swedish stood and one straightened.

"In all these experiments there was a much greater strain as well upon those articles which were not either broken or injured as upon those which were, than is ever applied in the actual use of such instruments on board of any ship."

EXPERIMENTS MADE AT CHATHAM DOCKYARD.

"Mr. Cort's anchor stood, the other was broken; and, in eleven other experiments, Mr. Cort's iron stood, four was injured in four, and broke in three instances. The Swedish iron stood in five, was injured in five, and in one broken; so that there appeared but little inequality, except in the anchor, in which the superiority of Mr. Cort's greatly overweighed the trifling inferiority of it in the aggregate of the other articles."

EXPERIMENTS MADE AT PLYMOUTH DOCKYARD.

"The superiority of Mr. Cort's anchor is sufficiently evident on this trial; of his other articles, two stood, three broke, and three gave way. Of the Swedish, three stood, three broke, and two gave way."

The Master Smith of this yard expressed his opinion that Mr. Cort's iron, used in the articles which were the subjects of the above experiments is equal to any he ever made use of."

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GENERAL REMARKS.

"The iron made by Mr. Cort, and tried against the best Swedish iron in the above experiments, was made from old ship ballast, which is a very inferior sort of cast-iron. The Orgrounds iron, against which it was tried, is the best refined, the strongest, and the toughest iron known or ever brought into use before Mr. Cort's discovery; about 20,000 tons of this iron are annually imported from Sweden, and paid for in money at a high price; besides which, about 50,000 tons of bars and slabs are annually imported from Russia; and about 30,000 tons of bar iron are annually made in England. But even if the whole quantity of a hundred thousand tons, one year with another, brought to market in this country in bars, slabs, rods, or other shapes, could be made by our manufacturers without the aid of this discovery, still the best of their iron (not only that which is made at the coke-fineries, but also that which they refine with charcoal, and of which the quantity supplied must always be limited) has not been esteemed of sufficient body, strength, and toughness for anchors, tackle-hooks, the strapping and hooks of blocks, bolts, and other ironwork belonging to the building, rigging, and navigation of ships, upon the perfect goodness of which the lives and safety of so many of His Majesty's useful subjects, the seamen of Great Britain, must depend; only the Orgrounds, imported from Sweden, has been hitherto esteemed sufficiently good to be depended upon for these uses, or to be supplied for the service of Government; but Mr. Cort's iron has been now proved to possess these qualities in a super-eminent degree; and, therefore, the chief questions seems to be, whether it can be manufactured in sufficient quantities, and at a reasonable price. As to the first of these points, although the bar iron at present made in England and Scotland, after the former methods, is not more than about 30,000 tons, as above stated, yet the reason is, that there is no larger demand in the market for iron so inferior in body and strength as much of this is found to be. The quantity of pig iron and castings annually made in Great Britain is not less than about 85,000 tons, which quantity might be very much increased by increasing the number of blast furnaces. At present, they are but about eighty-five in number in England, Wales, and Scotland, but many more might be worked if the encouragement was sufficient by a demand for pig iron equal to what Mr. Cort's discovery must occasion when it is brought into general use, for the raw materials are in a manner inexhaustible.

"The second strong circumstance in favour of this iron is, that even now in the infant state of the manufactory, it may be afforded cheaper than the Swedish iron. It is true that for the purpose of having the iron made, upon which the above experiments were tried, 60 tons of old ballast were delivered to Mr. Cort, and he returned no more than 29 tons 3 cwt. 0 qrs. 16lbs. in bars; but the bad quality of that metal, and the quantity of rust and dirt adhering to it, whereby the weight was increased, and some other circumstances disadvantageous to the yield, afford ample reasons why this should not be taken as a just criterion in that respect. For instance, some of the ballast was in large pieces, 5, 6, and even 7 cwt. and of such forms that it was impossible to break them; so that it became necessary to melt and run some of them down into pigs before they could be put into the finery-furnace. Others, which were put at once into the refinery furnace, were unwieldly, and therefore were both melted and worked with difficulty, and a very extraordinary waste. But added to these observations, the fact is ascertained, that in a regular course of working the refining furnaces, three men—two at work together, and the third taking his rest in turns—can with ease refine 4 tons of pig a-week from one furnace, which being afterwards rolled into bars at one welding heat, will produce bar iron of even the smallest dimensions (which might, if required, be also slit into nail rods, at the same heat in which the bar is first formed, and consequently without any sensible additional expense) of the quality above described, in the proportion of upwards of a ton from every 32 cwt. of pig, the quality generally used at the coke fineries, in making a ton of the largest size of mill bar iron.

"It may be further observed, that such bars as are required to be feather-edged, for the laying of shanks of anchors, are originally manufactured of that shape, and of dimensions exactly proportionate throughout, by means of Mr. Cort's rollers; and a saving is thereby occasioned of the fire and labour necessary to prepare Swedish bars into that form, and of the waste in heating and hammering, in order to fit them (though by far less perfectly) for the same use.

"And, upon the whole, notwithstanding the expenses unavoidably incident to such a discovery in its infant state, this iron can be afforded at a cheaper price, to be paid and circulated at home, than has hitherto been necessarily paid to foreigners, for an article so very important to Government and the nation, as the first sort of Swedish Orgrounds iron, upon which the preservation of His Majesty's fleet hitherto depended, but to which the iron manufactured according to this discovery has been proved equal for use in all respects, and superior in many particular instances. Among these, it cannot escape observation, that in all the five different trials upon large anchors, weighing from 34 to 59 cwt., those made of the furnace-refined iron had a manifest superiority over those made of the Orgrounds iron. In all these cases respectively, the anchors made of the two different sorts of iron were drawn equally against each other, with a purchase which it is almost incredible that either should have borne, before either gave way; and notwithstanding those made of the Orgrounds iron did give way at last, in all the trials, yet it was not till after standing a strain much greater than any other iron could have borne, or than the hardest actual service can be expected to require."

These elaborate experiments and severe trials, conducted under such varied circumstances and conditions (the details of which are fully stated) in all the royal dockyards, led to the conclusion that Cort, by his method of puddling and working by grooved rollers, could make, out of the worst material (ship ballast iron) an iron equal, and in some cases superior, to the best Swedish iron.

THE NATIONAL DEFENCES.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Perhaps you will allow me to state in your widely-circulated scientific miscellany, for the information of those gentlemen who are now proposing plans for the fortification of London, that I can suggest, and have long since made known to the Admiralty and the Government, the means whereby all the central and densely-populated portions of London, Paris, St. Petersburg, or any other large town, or a fleet of vessels in harbour, might, to a moral certainty, be speedily destroyed from a distance of ten miles and upwards if required, and comparatively, as regards all other modes of warfare, at a very trifling expense.

W. H. JAMES, C.E.

London, August 2, 1859.

REPORT OF THE ADMIRALTY COMMITTEE ON DOCKYARD ECONOMY.

THE Report of the Committee appointed by the late Admiralty to investigate the subject of Dockyard economy has come into our hands. It has not yet been presented to the House of Commons, and it cannot therefore be obtained through the ordinary channels of publication; but we have contrived to secure copies privately, so to speak, and doubt not that our readers will be glad to learn their contents without questioning the means by which we have possessed ourselves of them. As we shall have occasion to discuss this strange production elsewhere, it will be sufficient for us here to present the following "Recapitulation" of the substance of the Report, and the various recommendations which the Committee make. The Committee consisted of Rear-Admiral Smart, K.H., Mr. H. Chatfield, Master Shipwright of Deptford Dockyard, Mr. Andrew Murray, Chief Engineer of Portsmouth Dockyard, Mr. Robert Laws, Storekeeper of Chatham Dockyard, and Mr. Robert Bowman, "Civil Engineer and Shipbuilder," of 17 Paynton-terrace, East India Road. Mr. Chatfield has refused to sign the report, and appended a lucid statement of his reasons for withholding his name from the production of his colleagues. For the succeeding remarks he is therefore in no way responsible; all the credit, and all the disgrace of them belong exclusively to Admiral Smart, and Messrs. Murray, Laws, and Bowman. The recapitulation is as follows:—

The committee recommend that a *shipwright and an engineer officer attached to the Surveyor's department should visit the Dockyards and factories more frequently** for the purpose of promoting greater uniformity in the interpretation of orders, and in the mode of carrying on the work in the fitting and equipment of ships, and to explain the desires of the Board and of the Surveyor, when not fully understood.

They recommend that the *morning meeting* of the officers should be conducted in a manner to be of more service for communication and proper concert in carrying on the business of the yard than is the case at present.

They have made some remarks on *the subdivision of the supervision* as at present carried out amongst the chief professional officers of the Dockyards, and they have recommended that those officers and those branches which can best execute any work that is required, should be the parties to execute it, and that those officers who best understand the nature of the work should have the supervision of it. This will reduce the number of petty branches, by doing away with one wherever there are two separate workshops of the same trade in the Dockyards and factories. The division of responsibility, for the execution of the work, which is objectionable, but which has hitherto existed in the saw-mills, and other branches where machinery is employed, is also proposed to be done away with, by placing the men, as well as the machinery, under the charge of the chief engineer for the execution of any work that may be required by the shipwright department.

The Committee consider that the shipwright officers have devoted their time and attention too exclusively to the execution of work of the best quality, and within the shortest possible period, and that they have too much overlooked the question of *the cost of the work produced*. The fact that upon some urgent and pressing occasions cost is no object whatever in comparison with rapidity of execution, appears to have led them away from the due consideration of cost for production of ordinary work in ordinary times.

* These italics, and others which follow, are employed to facilitate reference to this document hereafter.—EDS. *M.M.*

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The want of a proper stimulus to Government officers for the efficient and economical management of the works under their charge being very apparent in the Dockyards, the Committee have recommended that the *cost of every ship built* for ordinary, or completed for sea, and the balance sheets of the chief manufacturing branches, showing the net cost of the work produced in the different Dockyards, should be printed annually with the Navy Estimates, and presented to Parliament, and circulated to all the Dockyards. If this were done, those officers who produced the work at the cheapest rate would have credit for it, and any officer who allowed the work of his department to cost too much, would be brought to account. Private manufacturers, also, would have an opportunity of judging whether the Government works were conducted satisfactorily or not, and would check any excessive cost.

The Committee found that *the offices for the foremen or leading men* immediately supervising the men in the different workshops were not generally well arranged to enable them to see their men while at work, and many of the shops themselves were badly arranged in this respect, and were lumbered up with material. They recommended that immediate steps should be taken to remedy this evil.

The Committee have given much attention to the subject of *superannuation to the workmen* of the Dockyards, and they are very strongly of opinion that the present system has an injurious effect upon the service, tending to protect an inefficient man and prevent him from being discharged, because the supervising officer considers that after he has served a few years he has a claim upon the service, and that he would lose this by his discharge. The wages paid to the Dockyard men are considered to be lower than those paid to men in private trade, and partly on account of their future superannuation. A feeling, therefore, exists that they are deprived of something which they have earned, and which is their due, if they are discharged; and this leads to an unwillingness on the part of the officer to recommend them to be discharged, or even to report them to their superiors for misconduct, lest this report should lead to that result. The Committee have recommended that for all future entries of workmen in the yards a system of deferred annuities should be adopted, so that every man on his discharge would take his annuity policy with him, and continue it thereafter or give it up at his own option. By this system the officers would be perfectly free to discharge inefficient or badly-conducted men at any time, and the men would have no cause of complaint: the annuity policy to be withheld if the man left the yard in the time of war, or time of pressure, when his services were required in the yard, and when other men could not be obtained.

The Committee have considered the working hours of the yards, and have proposed considerable modification in them. In addition to some other minor alterations, they have arranged a new table of working hours, so as to allow the men one and a half hours exact stopping time for dinner during the whole year, except on Saturdays, and thirty-five minutes stopping time for breakfast, except during seven weeks of the shortest days. The men, at present, are not allowed to stop for breakfast even in the summer time, which the Committee consider to be a very objectionable arrangement. They have also arranged the hours so that, without lessening the number of hours worked per week during the greater part of the year, the whole of the men of the Dockyard should leave off work on Saturdays at four o'clock. The Committee believe that these arrangements will be agreeable and beneficial to the men, and that they will also be beneficial to the Government, as the total number of hours worked in the year will be increased. The next subject treated of by the committee is that of the *entries of men*. They consider that the present arrangements have failed to secure in all cases the entry of the best men that could be obtained. They have pointed out in detail the modes which they would recommend for the entries of the names of candidates for employment, and they have prepared forms and certificates to guard against the entry of inefficient men or of any man inferior to any other who may be a candidate. They believe that if these forms are strictly acted up to and enforced, they will produce the effect desired. The Committee have also recommended *the entry of* a greater number of *boys* into the yards, and have pointed out where they may be employed with advantage.

The Committee have found that the *systems of promotions* have not been working in such a way as to ensure the appointment of the fittest men to the vacant situations. They have, therefore, proposed some alterations in the arrangements, and that the examination papers for the professional officers should be issued from the office of the Surveyor of the Navy under arrangements which they conceive will not throw much, if any, additional labour on his department, and will ensure uniformity at the yards. They found that by the present system of examination too little weight was given to practical experience and other points in the character of a man to fit him to be a good supervising officer, which could not be tested by any examination, and the possession of which tends to the want rather than otherwise of such knowledge as would enable him to be successful in a competitive theoretical examination on paper.

The Committee have also taken the liberty of referring to *the annual visits of their lordships* to the Dockyards and the master of the workmen, and they submit for consideration whether this should be continued, with the half-holiday to the men thereafter, at a cost of about £1,370 for all the yards.

The Committee have given much consideration to the three systems under which the payments are made to the workmen for their labour on work performed at the Dockyards. The first system is termed *task and job*, by which a definite sum of money is paid for each specific piece of work in detail according to an established scheme of prices without defining the whole sum for which a ship or structure is to be completed. The second system is known at the present day as "*day pay under check measurement*," and is nearly the same as that formerly known under the term of "task and job, limited earnings." Under this system, the men are employed on a fixed rate of day pay, and the work performed by them is measured and valued weekly, by the scheme of prices for task and job work, and the men are paid the amount of their week's pay if the value of the work is equal thereto, but if a greater quantity of work has been done, and its value exceeds this amount, they are not paid this excess of earnings, and thus they are not paid for the whole of the work which they have performed, while if the value of the work falls short of their week's wages, they are mulcted to the extent of the deficiency, and do not receive the full amount of their fixed day pay. The third system is the employment of the men on *day pay*, depending upon the supervision of the officers for the exertions of the men, and, therefore, for the quantity of work performed. The Committee have shown in their Report that the system of task and job has been subject to much abuse. Sister corvettes of 1,462 tons, costing upwards of £3,000 more for shipwrights' labour in one yard than another, though both were paid for by measurement of the work upon them, under the same scheme of prices, and though the work upon both must have been nearly identical; and they have also pointed out other cases of similar discrepancy. They have also shown that the system of day work under check measurement is injurious to the service, as checking the energies of the men who know the prices for each piece of work and value the work as it progresses, and do no more than is sufficient to cover the amount of their weekly wages; and that done, they feel, and tell the officers, that they have no right to exact more. The Committee have recommended the discontinuance of both of these last-mentioned systems, and that all new ships should be built on a system of piecework, defining the price for the whole ship as in private trade. They are of opinion that one of the assistant-surveyors, and an intelligent assistant-master shipwright would require to be directed to make themselves acquainted with this system, as worked in private trade; and that a foremen from a private trade, accustomed to it, should be engaged to introduce it first into one of the yards, and subsequently into the others. The Committee make this recommendation because they attribute the failure up to the present time of obtaining for the Government under task and job work the same advantages that accrue in private trade from the system of piecework to the want of a proper knowledge of how to work it. The Committee consider that all work to which this system cannot be applied should be done by day work under proper supervision; and that all work should cease as soon as possible to be performed under the present system of task and job. The experience of every day confirms the Committee in this opinion, and they would recommend that the leading men should be arranged as soon as possible in the positions recommended in the report, and that all the men should be put upon day work with extra hours, till the arrangements are completed for building new ships by the system of piecework as recommended.

The yards are at present worked under the system of task and job, and the cost of the staff of measurers at present employed amounts to the large sum of £15,252 per annum. This is in addition to the ordinary supervision, and for a staff of non-productive men. The cost of the ordinary staff of measurers, with their writers, messengers, &c., is £5,250, as provided for by last year's navy estimates. By the system proposed by the Committee these sums will be entirely saved, and all the advantages of piecework will still be secured to the Government on all new work and extensive repairs. Eight of the *corvettes* before referred to cost, for shipwrights' labour, without fitting for sea, 109s. 8½d. per ton, and one fitted for sea cost 173s. 11d., while it was stated in evidence to the Committee that a corvette, if built in a private yard, with scantlings, fastenings, and workmanship similar to ships in Her Majesty's navy, fitted for sea, would be about 52s. only per ton for shipwrights' labour. Allowing for any superiority of workmanship in the Dockyard, or other difficulties, the Committee can see no reason why ships should not be built for a price in the Dockyard at least approaching to that paid in private trade, if the same system of working the men as now recommended be adopted, instead of their costing, as in the case quoted above, more than three times as much.

With respect to the present *shipwright officers* the committee are of opinion that there are too many grades, and that a want of clearness exists in defining the duties of each grade. They consider that the present *leading men* are in a false position, sharing in the earnings of the gang of men to which they belong when on task and job, and expected to perform the duties of a supervising officer on behalf of the Government. The Committee have commented fully upon this in their Report, and they recommend that the position and pay of the leading men should be raised, and that the class of inspectors should be done away with. They also consider that the *foremen* are more in number than are necessary. By the supervision as proposed by them in their Report, and which they feel confident will be sufficient and superior to the present system, an annual saving in salaries to these classes of officers will be effected to the amount of £9,463 per annum. The Committee have laid down definite rules for the *appointment of leading men and foremen*, which will ensure greater practical experience in these officers than has hitherto existed in all cases.

The Committee have also made arrangements respecting *draughtsmen* for the mould loft, who require more education; and they have made

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arrangements for their promotion separately from the more practical officers.

The Committee have given much attention to the subject of providing for a future supply of men, properly educated, to be fit to fill the position of the *superior officers in the shipwright department*. All the officers of the late school of naval architecture are now well advanced in years, and the want of properly-educated successors is becoming seriously apparent. At the last examination for assistant master shipwrights, not one of the candidates came up to the very moderate standard of scientific knowledge laid down as necessary by their Lordships' circulars of 1847 and 1853. The Committee have made recommendations respecting the promotion of the better educated and superior men from the class of workmen, and have at the same time recommended the introduction of *superior class pupils* to be trained in the dockyards, but without entailing any expense in the form of schools or professors, the number required being so limited. They have recommended the entry of two such pupils at once, two in three years, and one in every third year thereafter, which will be sufficient, with the superior men rising from the ranks, to fill the number of positions as assistant-surveyors and masters-shipwrights, and their assistants at the yards. The Committee consider that none but these last-named officers, about twenty in number, required to be possessed of superior scientific acquirements, and to be men of general knowledge and general experience; and that all these officers should be looked upon as superior officers, and distinctly marked from the grade of foremen, who should be experienced practical men. The Committee have, therefore, recommended that a clearer line than hitherto should be drawn between these classes of officers, in the same manner as between the commissioned and non-commissioned officers of the army and navy.

Respecting the *joiners' department*, the Committee have made some recommendations with a view to improve the supervision, and have recommended the increase of the use of machinery in that department in some of the yards.

The *wheelwrights department* was found to require improvement in most of the yards, both as regards supervision and machinery.

The Committee have recommended the entry of more *painters*, instead of continuing the practice of employing labourers to such an extent as has hitherto obtained.

With regard to *labourers*, the Committee consider that the supervision over them hitherto has been far below what is required, and they recommend the appointment of two foremen, under the boatswain of the yard. They also recommend an increase of wages to the labourers, as they are satisfied that the wages of 13s. per week, as now given, are not sufficient to maintain a man in proper working condition if he has a wife and family depending upon him. The Committee found the complaint general that there were not enough labourers to save the employment of skilled artificers at high wages to do labourers' work, and they have recommended that labourers be added to the different workshops, and that two labourers should be attached to, and form part of, every gang of shipwrights, to fetch stores and remove chips, shavings, &c. They also recommend that *scavelmen* be re-introduced to work for the shipwrights, erect stages, assist in getting heavy weights on board ships, and other work.

The Committee recommend that the *saw mills*, as is the case at Chatham, the *millwright shops*, and the *smitheries* at all the yards, and the *block mills and distilling apparatus* shop at Portsmouth *should be placed under the chief engineer*, for the reasons before referred to.

The Committee have made recommendations for improving the efficiency of the *metal mills at Chatham*, as also the *lead mills* there.

The Committee recommend that the East *Ropery at Deconport* should be converted into a spinning mill, in addition to the increase of the spinning machines at Chatham for spinning yarn by machinery for the whole service, and that the laying machinery at Chatham and Devonport should supply the whole service with rope. The expense of the separate establishment at Portsmouth would thus be saved, and the building would become available for other purposes for which it is much needed, and which are pointed out in the Report.

The Committee recommend that more complete housing should be built over those *ships placed in ordinary*, and that those ships intended for ordinary should be so fitted and be kept in ordinary as long as there are any other vessels of the same class not so fitted which are available for service.

The Committee recommend the use of chain cable instead of the long-linked mooring-chain for the moorings of the ordinary, as being both more economical in itself, as shown by the details given in the Report, and much more easy and economical to work.

The Committee recommend improvements in the means of *locomotion in the yards*, and that a more definite system of ordinary rails should be laid down in all of them capable of taking locomotive engines, but without use of them for the ordinary traffic. They consider that these rails would be more advantageous than tramways or traction engines.

With respect to the *dockyard schools* the Committee have made several recommendations. They consider that no boys should be selected above their companions to receive a superior education, and then be expected to return to their work thereafter as mechanics. They recommend that the school-room should be opened gratuitously in the evenings to a limited number of men as well as boys, and that the schoolmasters should then act in the same manner as private tutors to those who may be attending, giving instruction to each individually, and not as a class.

With respect to the *clerks of the dockyards*, the Committee consider that the examination before entry should include mensuration of surfaces and solids, as their duties require them to take the measurements of works and of timber and other materials. The Committee also consider that the discipline of the clerks in the offices is not in a satisfactory state, and they therefore recommend that the signing of the declaration enforcing obedience to all senior to them in their department, as required by the instructions, should be attended to at all the yards. Clerks appear also to have been promoted by seniority alone in some cases, and without reference to the opinion of the officer under whom they were serving, which is prejudicial to the service. The Committee have found that the quarterly certificate that the conduct of the clerk had been satisfactory during the past quarter, before he is to receive his salary, has in some yards fallen into disuse, and they consider that it has failed in being useful by being too severe. No superior officer is inclined to deprive a clerk of his whole income by taking upon himself to refuse to sign this certificate merely because the clerk has not been so diligent as he might have been. The Committee have therefore recommended, in lieu of this certificate, that a certificate should be required from every chief officer under whom a clerk may be serving, before he receives the annual rise of pay due to his position, stating that his conduct and attention have been satisfactory. The Committee are of opinion that this power in the hands of a superior officer will be duly exercised by him, and will be productive of much good; but the refusal of the certificate should not be looked upon in too serious a light by the authorities in London, and lead them to believe that because it is refused an inquiry should therefore be made whether the clerk should be retained in the service; because, in that case, again, the strenuousness of such a measure would make the superior officer hesitate to refuse the certificate, and the object of stimulating any young clerks who are capable of exertion, but who have only been idle or indifferent, would be lost.

The Committee have recommended a man of better standing than the present *leading man of storehouses* to be placed over the stores, to attend especially to the issues, as the clerks in the storehouses are occupied in their duties in the offices, and cannot attend to this duty personally.

The Committee found generally a want of attention to keeping up a store of properly *seasoned material*, especially for joiners' use and for wheelwrights' use, and they recommend greater attention to this point.

They consider that the *contracts and schedules* require revising, as well as the standard patterns. They have made remarks in their Report on several points connected with the receipt of stores, especially as regards the chemical analysis of copper, paint, &c., at Chatham, the repair of articles for store, the preservation of stores—especially made masts and mast timber—and the appropriation of obsolete stores.

With respect to the *Director of Work's department*, the Committee recommend more concert with the department who are to use the buildings about to be erected; and they show reasons in the Report for this recommendation.

They recommend an alteration in the system of taking the *local contracts*, so that the Government material may be more largely used; and they recommend the engagement of a few workmen, under the clerk of works, to be employed on small jobbing work, now done by day-work by men under the contractor.

With respect to the *factory department* the Committee recommend that the men should be continued as hired men; but that a system of deferred annuities should be introduced, free from the objections to the present system of superannuation for the Dockyard men. They do not recommend the introduction of task and job work into the factories. They recommend the printing and appending the balance sheets to the navy estimates to give a stimulus to the officers to conduct the works under their charge economically. They recommend greater control to be exercised over the stock of stores in the factory storehouses by the storekeeper of the yard, and over the cash payments of wages of the factories by the accountant of the yard. They recommend additional supervision over the factory at Sheerness. They recommend more definite pay and position to the junior superior officers of the factories, and that the qualification of those officers should be more thoroughly tested before they are appointed.

In conclusion, the Committee remark "that many of the recommendations submitted by them are not supported by the evidence of the officers of the Dockyards; but they are in accordance with the practices of private trade." They finish by saying:—"The Committee have had occasion to point out many alterations, but they have proposed no changes where they did not think them necessary for the improvement and the future well-being of the service in the Dockyards, and they feel that wherever they have pointed out faults, these faults are to be attributed more to the system as a whole than to the men. Errors and faults will gather and increase with the age of every establishment, and few establishments of such old standing as the Dockyards will bear comparison with private establishments of the day; but it is the comparison which the Committee have endeavoured to bring to bear upon them; and they think that credit will be given to them for having had no other object in view in their remarks than the benefit of the service."

The following paragraph is going the round of the newspaper world:—"The Austrian (?American) telegraphist, Mr. Hughes, has added another great improvement to the science of telegraphy. He has invented a telegraph which at once supersedes the whole system of telegraphic signals as now in use. The new instrument, without causing more wires to be used than at present, transmits messages, indicating those messages to the eye by the ordinary letters of the alphabet. The advantage of the instrument is, that it can be used by any person who can spell a message. It is small and portable. Any railway guard may carry one in his pocket." We need only say we do not believe this.

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THE PUMPING ENGINE AT THE NEWCASTLE WATERWORKS.

FIG. 4

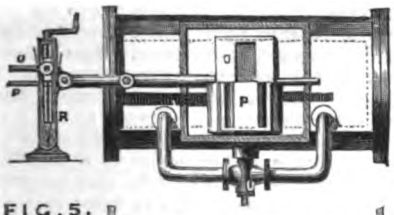
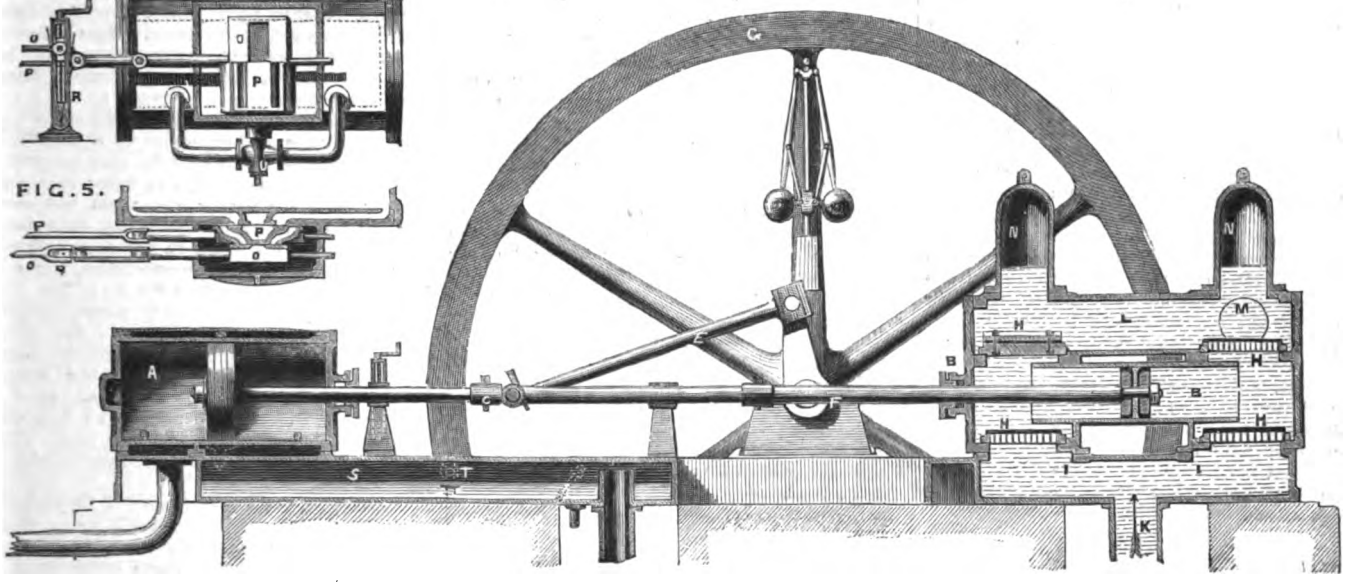


FIG. 5.

FIG. 1.



THE PUMPING ENGINE AT THE NEWCASTLE WATER WORKS.

By Mr. Robert Morrison, of Newcastle-on-Tyne.*

The pumping engine forming the subject of the present paper was constructed by the writer for the Whittle Dean Water Works, and has been erected near Benwell, a village about two miles west of Newcastle-on-Tyne, where filter-beds and an extensive pure water basin have likewise been recently constructed. About ten miles west of Benwell, at Welton, there are eight extensive collecting and settling reservoirs, called the Whittle Dean reservoirs, containing at their ordinary high water level 600 million gallons of water, but capable of holding a much greater quantity. The average low-water level of these reservoirs is 360 feet above the high water line in the Tyne, and the water is conducted into the towns of Newcastle and Gateshead through a 24-inch cast-iron main by gravitation. Owing to the extension of these towns up the banks of the Tyne, considerable portions of them are above the level to which the water will flow direct from Welton. To supply these districts an engine and reservoir were constructed some years ago at Gateshead; which afterwards proving insufficient through the increased demand for water, the engine here described was erected, and can now at all times supply the highest districts by gravitation alone with an unlimited quantity of water.

Down the bank opposite Benwell, at about the level of high water in the Tyne, runs the 24-inch Welton main, from which a 10-inch branch has been led up the hill side a distance of 2,240 feet to the filter beds already mentioned, which are placed at a level of 246 feet above the high water line in the Tyne. The water passing from the beds to the pure water basin is conducted to the engine suction pipe, and is driven through another 10-inch main 3,850 feet long into a second recently formed reservoir at the top of the bank at High Benwell, 412 feet above high water in the Tyne, from which the town is supplied through a 10-inch main. When it is not required to pass the water through the filtering beds or pure water basin, the 10-inch branch from the Welton main delivers the water into a well 20 feet deep, whence it is pumped by the engine as before to the second reservoir up the hill. The height from the bottom of the well to the end of the delivery pipe in High Benwell reservoir is 182 feet, which is the height the engine has been lifting during the experiments; for the depth of water in the well has generally been about equal to the depth of water in the high reservoir.

FIG. 2.

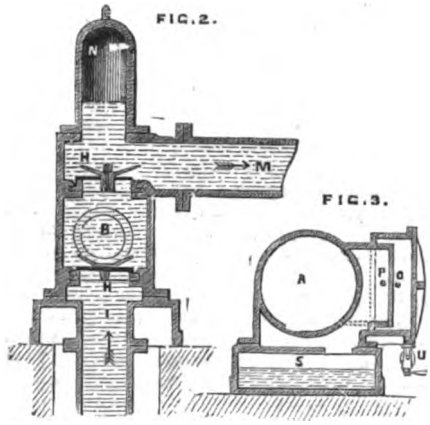


FIG. 3.

The pumping engine, which was erected twelve months ago, is a horizontal high-pressure expansive and non-condensing engine, working direct a double-acting pump, and coupled to a crank and fly-wheel. Fig. 1 is a longitudinal section and sectional plan of the engine and pump. Figs. 2 and 3 are transverse sections through the pump and through the steam cylinder.

The steam cylinder *A* is 26 inches diameter and 4 feet stroke, and the pump *B*, which is worked from the same piston rod, is 11¼ inches diameter. A crosshead is keyed upon the piston-rod and guided by a cylindrical slide *C* on each side, working on round guide-rods carried by brackets from the bed-plate; and the connecting-rod *E* is coupled to the crosshead close to the piston-rod *F*, which is lengthened sufficiently to allow the crank to clear the end of the pump *B*. The crosshead is made solid in one piece with the cylindrical guide on the side, to which the connecting-rod is attached, and the other side is made with a socket and keyed. Each guide *C* is provided with two set screws to allow of tightening up the brasses as they wear. The fly-wheel *G* is 16 feet diameter and 5¼ tons weight. The pump *B* is double-acting, and has a solid piston fitted with cupped leathers facing both ways, with a brass piece between them to preserve the leathers from being cut. The pump-valves *H* are rectangular butterfly valves of india-rubber 1¼ inch thick, beating on ½-inch bars, with 1 inch spaces; the total area of opening in each valve seat is 112 square inches. The suction-valves open from a chamber *I* in the bed-plate to which the suction-pipe *K* leads from the well; and a back-flap valve of india-rubber is fixed at the extremity of the pipe *K* at the bottom of the well, 20 feet below the pump suction-valves. The delivery-valves are exactly similar to the suction-valves, and immediately over them, and they are connected by a horizontal pipe *L* parallel to the pump *B*, from which the delivery-pipe *M* leads off, proceeding direct to the main. A branch is carried off obliquely from the main to the air vessel, which is situated outside the building, and is 3 feet diameter and 12 feet high. Two small air-vessels *N N* are also fixed on the top of the pump *B*, immediately over the two delivery-valves.

The steam cylinder is fitted with a separate expansion slide working on the back of the ordinary slide valve. This arrangement is shown enlarged in Figs. 4 and 5. Both slides are worked by fixed eccentrics, but the expansion is made variable by means of a slotted link *R*, vibrating on a centre fixed to the bed plate, and permanently connected to the rod of the expansion slide *O*, which is attached to the centre of the link, the eccentric rod being connected to a sliding block worked up and down the slot by means of a screw, which can be readily adjusted whilst the engine is at work. There is an index on the side of the link to show the degree of cut-off. The exhaust steam is discharged into a cistern, *S*, cast in the foundation plate, into which the cold feed water is injected through a perforated pipe, *T*; by this means the feed water is heated, and is then pumped from the cistern into the boiler. A glass gauge on the side of the cistern indicates the level of the water, as it is desirable that there should not be more than 3 inches deep in the cistern.

As the eccentrics are fixtures on the fly-wheel shaft, and the rods permanently connected to the side valves for the sake of simplicity and durability of construction, a special arrangement is provided for starting the engine by means of a two-way cock *U*, Fig. 4, attached at the bottom of the steam chest, and connected by small branch pipes to both steam ports, by which the steam can be turned into either port beyond the valve, and the engine readily started. There are three Cornish boilers with single flues, having the fire in the flue; the boilers are 28 feet long and 4 feet 9 inches diameter, and the flues 3 feet diameter; but only two boilers at a time are used for working the engine. The fire-doors are arranged to admit any quantity of air, and regulated in such a manner as to be under the control of the engineer; the result is perfect combustion and the

* Read at a late meeting of the Institution of Mechanical Engineers.

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entire absence of smoke with the Benwell pit coal.

The steam is maintained at 60 lbs. per square inch above the atmosphere, and the engine is usually worked with the steam cut off at one-fifth of the stroke. The main slide, *P*, having always exactly the same motion, whatever be the degree of expansion, the opening of the exhaust and the amount of compression are constant. The usual speed of the engine is 24 revolutions per minute, or 192 feet per minute speed of piston; but it has been worked up to 40 revolutions, or 320 feet per minute of the piston. The pressure of water upon the pumps as indicated by a pressure gauge is 80 lbs. per square inch when standing, and rises to a mean of about 95 lbs. per square inch whilst working, equivalent to 18·6 lbs. per square inch effective pressure on the steam piston, or 57 horse power effective. Taking the coals consumed for 3 months, the consumption is 30 cwts. per day of 12 hours, including lighting fires, &c., or 5 lbs. of coals per effective horse power per hour, and 4 lbs. per indicated horse power per hour. It will thus be seen that the consumption of coals is not much more than if this engine had been a condensing one, whilst the first cost of the engine and building is much less, and the smooth and steady motion of the machine is much in its favour when compared with the beam engines.

BREAKWATER AT THE PORT OF BLYTH.

By MICHAEL SCOTT, C.E.

(*Concluded from p.* 72.)

THE author does not recommend the plan of depositing rubble up to low-water mark, and then erecting upon this a wall either of stone, or timber and stone, considering such an arrangement to be incorrect in principle; but he does recommend that the wall be built from the bottom, or from about 15 feet below low-water. No doubt the first-mentioned plan has been adopted, chiefly on account of the difficulty and expense of building under water, but the author hopes to show, that these need no longer be regarded as such formidable objections. In the system hitherto adopted for building piers under water, the operations have been confined to one end of the work, and the progress has, consequently been very slow, the pier at Dover, for instance, advancing only at the rate of 100 feet per annum. This slow progress is mainly to be accounted for by two great obstacles to the operations of either helmet-divers, or of bells, which are current and ground swell; and with respect to the former, the further the pier projects the more rapid is the current past the end likely to become; indeed, in some cases, the scour might endanger the stability of the work. Now, it will be observed, that in facing an existing pier, the work might proceed with great rapidity, for it might be carried on at a number of places at once, and there would be little, if any, current to interfere with the operations.

To illustrate the advantages in these respects, the author will describe the method proposed by him for completing one form of the permanent work. Suppose the form of breakwater shown in Fig. 4 to be selected. Frames are sunk at intervals of 30 feet, and stand on the natural bottom. Rails being laid on balks of timber between these principals, rubble is tipped from waggons to form the bank, of the dimensions shown, up to a level of 17 feet below low-water; and the intermediate frames are then erected upon it, leaving spaces of 5 feet. On the outside of these frames, above low water, planks are attached, and are secured by pieces of timber bolted through to the frames. The object of placing them on the outside is to allow of their being easily removed afterwards. Below low-water, the spaces are filled in with panels, or vertical pieces, secured by the sliding ties, as shown in Fig. 5. The interior is then filled with rubble, up to 6 feet above high-water, and covered with an open flooring of timber. On the sea side, a parapet is carried up, and there is then a breakwater sufficient to last for many years. For the purpose of forming the permanent stone face, the projecting portion of the rubble bank is to be levelled, and upon this large blocks are to be laid. With regard to the composition of these blocks, on the author's system, even when the mass of the block was composed of ordinary material, the face exposed to the sea would be hard and impenetrable, and yet the evil of a distinct line of demarcation between the face and the body of the block would be carefully avoided. As these blocks are deposited, the planking is to be removed, and the space between the face-work and the original rubble heart is to be carefully filled. There are some peculiarities in the method proposed by the author for setting these face-blocks. It may be stated generally, that the main objects in view are, first, to afford increased facilities for handling heavy masses, and secondly, as a considerable part of the faces must be built under water by divers, to place within easy reach of these men the power of moving the stone in every direction, without the necessity of communicating with any one above water.

It has frequently been proposed to employ large concrete masses in the building of piers: one principal reason which suggests itself to the author for this idea not having been extensively put in practice, is the difficulty of handling such great weights. As has been stated, not only must the staging be of great strength, but the crane gearing to deal with say 25 tons must be cumbrous and expensive. As regards hydraulic machinery the difficulty is to arrange it, so that it shall not be still more so. Now as the author proposes to deal with masses weighing more than 25 tons, it is essential to devise some method of moving them, and the following is the result:—With the aid of bars, divers can do something with blocks weighing from 5 to 8 tons, as so much of the weight is neutralized when they are immersed; but even with these, when laying a face course, it requires the signal-man to act in perfect unison with the diver, or time is lost. It will be observed that, in the case under consideration, the work consists only of face courses, and is composed of blocks of such weight, that so far as any direct action on the mass is concerned, the divers would be nearly helpless. Hence arises the necessity of employing some new means by which the diver would be able to move the blocks in every required direction. This involves six distinct motions—down, up, forward, backwards, to the right, and to the left. The apparatus* which the author proposes to employ may be briefly described as follows:—There is a traversing frame, with one end projecting over the side of the pier. This frame moves by means of wheels upon four lines of rails. Upon the inner end of the frame is placed an accumulator (which was patented by the author in 1851), which serves at once as a reservoir of power, and a back balance. Upon the front end of the frame, there is a cross frame carrying a crab. The operation of depositing a block is performed thus: the block is conveyed on a waggon under the traveller; the crab is over head, and instead of the chain being attached directly to the mass, a cylinder containing a piston is interposed, the cylinder hanging from the chain, and the piston-rod being connected to the block. A flexible tube from the lower end of the cylinder communicates with the accumulator, and a stop-cock being opened, the water flowing from the reservoir under pressure forces up the piston, and lifts the block. When thus suspended the crab is moved, by means of a rack and pinion, to near the end of the frame, and then, with the aid of the break, the workmen lower the block until it rests on the previous course. He then fixes the break, and the mass is consigned to the care of the divers. If the diver wishes to raise the block, he opens the communication between the accumulator and the cylinder, and the piston is forced up. When the block is raised far enough, he shuts the cock, and it remains suspended. When it is desired to lower the block, a second cock is opened in the same tube placed between the first and the cylinder which allows the water to flow out of the latter and the mass descends. If the block is to be moved laterally, the piston of a small cylinder fixed to the framing above is attached to the crab by means of a chain passing over a pulley, fixed on the opposite end of the frame. This cylinder is connected directly with the accumulator by means of a tube, and the communication being always open, the tendency is always to draw the crab to the left. Another cylinder is fixed in the opposite direction, and connected to the crab in the same manner. This cylinder also communicates with the accumulator, and being larger in diameter than the former one, when the communication is opened, it draws the crab from left to right, and the water in the first cylinder being forced back into the accumulator, there is no loss of power arising from the use of the first cylinder. The tube connecting the second cylinder with the accumulator passes down to the divers and up again. When the crab is to return to the left, the communication between the second cylinder and the accumulator is shut, and another being opened, the water is allowed to flow out, the small cylinder pulling the crab back. The motion forward and backward is communicated in the same way.

It will be seen that by means of three tubes within reach of the divers, motion in every direction is obtained, without the necessity of communicating with any one above water. It is thought that by the means now described the great difficulty of signalling is overcome; for that difficulty does not consist so much in indicating the direction in which the motion is required, as the amount of that motion. This becomes of more than ordinary importance in the case of large blocks, which men cannot easily swing from the perpendicular.

For moving the great frame, a long cylinder, of small diameter, is fixed at each side of it; the piston-rods are hooked on to chains made fast to the forward end of the work, and the water being admitted as before, the frame is moved forward. When the piston reaches the end of the stroke, it is drawn out and is again hooked on to the chain; this can be easily effected by continuing downwards for a few feet the tube which empties the cylinder, as it tends to produce a partial vacuum.

* For drawings of this apparatus see "Report of the Commissioners, &c., on Harbours of Refuge," vol. i., Plate 3. Folio. London. 1859.—M. S.

THE COMMISSIONERS' OF PATENTS REPORT OF 1858.

THE Commissioners of Patents appointed under the Patent Law Amendment Act, 1852, (15 & 16 Vict. c. 83.) in compliance with the terms of the third section of that Act, make the following Report of their proceedings under and in pursuance of the same for the year 1858, in continuance of their Report of proceedings for 1857.

The number of applications for provisional protection recorded within the year 1858 was 3,007; the number of patents passed thereon was 1,954; the number of specifications filed in pursuance thereof was 1,880; the number of applications lapsed or forfeited, the applicants having neglected to proceed for their patents within the six months of provisional protection, was 1,047.

The Act 16 Vict. c. 5. enacts that all Letters Patent for inventions to be granted under the provisions of the Patent Law Amendment Act, 1852, shall be made subject to the condition that the same shall be void at the expiration of three years and seven years respectively from the date thereof, unless there be paid, before the expiration of the said three years and seven years respectively the stamp duties in the schedule thereunto annexed, viz., £50 at the expiration of the third year, and £100 at the expiration of the seventh year.

Two thousand and forty-four patents bear date between the 1st July 1855 and the 30th June 1856; the additional stamp duty of £50 has been paid on 568 of that number; and 1,476 have become void by reason of non-payment.

All the provisional, complete, and final specifications filed in the office upon the patents granted under the Act have been printed and published in

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continuation, with lithographic outline copies of the drawings accompanying the same, and within three weeks of the respective dates of filing, according to the provisions of the Act 16 and 17 Vict. c. 115.

The provisional specifications filed in the office and lapsed and forfeited, have also been printed and published in continuation.

Printed certified copies of the specifications filed in the office, as also certified copies of patents, and of the record book of assignments of patents and licences, with copies of such assignments and licences, have been sent, in continuation, to the office of the Director of Chancery in Edinburgh, and the enrolment office of the Court of Chancery in Dublin, pursuant to the Act of 1852 and the Act of 16 and 17 Vict. c. 115.

The work of printing the specifications of patents under the old law, 12,977 in number, and dating from 1711 to 1852, having been completed, the Commissioners of Patents have directed short abstracts or abridgments of specifications, grouped under the different heads of invention, to be prepared and published; for example, abridgments of the specifications of patents relating to the propulsion of vessels, commencing in the year 1618 and ending 1857, comprising nearly 1,000 inventions, have been published in three parts, making one small volume.

Abridgments relating to the following subjects of invention have also been published:—Drain tiles and pipes; manufacture of iron and steel, 3 parts; manures; sewing and embroidering; preservation of food; aids to locomotion; steam culture.

Other series are in the press, and it is intended to publish at the rate of six or eight series in each year, completing the work in eight or ten years.

These abridgments are sold at prices a little above the cost of printing and paper.

To the above Report is appended the Report of the Commissioners of Patents on the subject of the building of a patent office and a public library which has been transmitted to Her Majesty's treasury, together with the annual financial papers of the office.

IMPROVED SIGNAL LAMPS FOR THE NAVY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

17 Guildford-road, South-st., Greenwich, 2nd August, 1859.

Gentlemen,—In 1856 I took out a patent for improvements in ship signal-lamps, pier-head lights, &c., and having on the 28th ult. taken out through you another patent for further improvements of the same, and lighthouses generally, I beg through your valuable journal to give a brief description of the merits of my new patent.

I am, Gentlemen, yours obediently,

J. Weir D. Brown,

Late Demonstrator of Anatomy at the London Hospital.

In the first place I beg to say a few words on the subject of my former patent, all the lamps manufactured under which are constructed of square lenses shaped in such a manner that at the edges where they join their fellows lenses are formed, so that the whole extent of glass consists of combined *diffusing* lenses, and when the lamps are lit many points of power are obtained, which causes the light to become larger, more powerful and brilliant, and thereby penetrates through a haze when the ordinary lights are invisible, which is the critical time when a light is of value for the prevention of collisions, loss of life and property at sea. The power of my lamps has been fully proved at trials ordered by the Board of Admiralty, Trinity, &c., &c., and I crave your indulgence by allowing the enclosed reports on their merits to be inserted:—

H.M. Victualling Yard, Deptford, 6th November, 1857.

Sir,—Having on the 27th and 31st ultimo witnessed from this Yard the signal light in the lamp of your invention, when displayed with one of the pattern now in use in the Navy, near the Observatory at Greenwich, I have no hesitation in saying that in both instances the brilliancy of your light greatly excelled that of the other, more particularly so on the latter occasion, when the haze rendered it difficult to distinguish the Navy lamp with the aid of a glass, whilst yours was very distinct to the eye.

I remain, Sir, your obedient servant,

E. J. P. Pearn, R.N., Master Attendant.

Mr. J. W. Brown, 25 Wickham-terrace, Deptford.

R.M.S.N. Company's ship Tamar, Southampton, 8th June, 1859.

Captain Vincent, R.N., Superintendent.

Sir,—I have much pleasure in being able to report most favourably of the mast-head lamp put on board Tamar previous to her last voyage.

I have tested it against our own lamp, and although Dr. Brown's is smaller, yet the light is much more brilliant, and can be seen a considerable distance further in hazy or foggy weather. The lamp also wanted no trimming, and was as bright after eight or ten hours burning as when first lighted; so much pleased was I with it, that after leaving Lisbon I used it entirely, as I considered that by being seen so much further it might lessen the chance of collision.

I hope I may be allowed to retain Dr. Brown's lamp. I am, Sir,

Your most obedient servant,

(Signed) John H. Jellicoe, Commander.

My new patent consists in constructing lamps, lighthouses, &c., out of tiers of lenses placed one above the other, the perpendicular edges of which are so mitred that they join their fellows like the key-stones of an arch, and according to the angle at which they are mitred so a circle or half circle of any extent can be formed.

For the sake of illustration I take a lamp showing half a circle, constructed of three tiers of lenses, each tier consisting of 10 plano-convex lenses shaped on my plan, so that where they join their fellows lenses are formed. The interior will present a series of 45 *distinct flat surfaces*, 15 to each tier, without metal work separating them. The external appearance will be half spherical, the lenses of each tier being so blended one with the other that no depressions exist between the several lenses which can cause a break in the light.

Having as briefly as possible described the construction of the lamp, it will be seen that I get in contiguity forty-five distinct and direct powers of light, which all become, if I may use the expression, so amalgamated that the result is a more considerable increase of size, power, and brilliancy of the light than is possible to be obtained from a lamp or lighthouse constructed of one large lens or piece of glass, because the power of the light, although the lens may be well filled, becomes weakened from the centre or focal point having to supply so great an extent of glass. This point has been clearly proved at the different trials of ships' lamps—small lamps on my principle having shown a much more brilliant light than the larger lamps tried against them.

Take two lighthouse or pier-head lamps of the same size, and the one constructed under my new patent will give 20 or 30 times more light than is possible to be obtained from those in ordinary use, and which causes my light to be seen to advantage in hazy or foggy weather.

Another great advantage which a lighthouse or lamp constructed on my principle would possess would be the regulating the power of the light. For example, so much power is not required on a clear as on a hazy or foggy night—on the former occasion, only the upper and lower tiers of lenses need be lighted; on the latter occasion, all the tiers of which the lamp is constructed.

One of the new lighthouse lamps is, by order of the authorities of the Royal Yacht Squadron, about to be erected at Cowes.

J. W. D. B.

HALL'S PATENT RAILWAY BRAKE APPARATUS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen:—In a report lately addressed by Captain Galton, R. E., to the Lords' Committee of Privy Council for Trade, on the Accidents which occurred on Railways in the year 1858, that experienced officer says:—"Safety from collisions would be very largely increased if the guard or the engine-driver of a train were enabled to apply brakes to a sufficient number of carriages to enable it to be stopped in 300 or 400 yards. The application of brakes to several of the vehicles of a train, instead of only one to a heavy brake van at one end, causes far less wear and tear to the rolling stock and the road." And again, in the same report, Captain Galton says, that a certain gentleman's brakes "are efficient, but not perfect," and that "they require to be adjusted periodically as the brake blocks wear away," adding, "the efficient action of a system of continuous brakes, no doubt, to some extent, depends upon the adoption of the system by all companies who interchange carriages or railways; but if the larger railway companies would adopt a system of continuous brakes for their own stock, the cases would be few where careful arrangements in making up the trains would not enable the system to be effectually applied."

From these observations I am undoubtedly at liberty to conclude (1.) That if the railway companies would adopt an efficient system of brakes, the public would, Captain Galton believes, derive a large increase of safety. (2.) That Captain Galton considers the following conditions essential to a perfect (and therefore an efficient) system of brakes, viz., (*a*) that the system shall be applicable to numerous carriages of a train; (*b*) that it shall not require adjustment because of the wear of the brake blocks; (*c*) that it shall be such as will afford no obstacle to the interchange of carriages among railway companies. In addition to these conditions, the able and gallant officer whom I have quoted would, of course, further require that the system should be moderate in cost, simple in construction, ready and certain in its action, and unattended by any large amount of labour or trouble.

Now, I am fully prepared to show to any railway director, manager, engineer, or other official person, that the system of railway brakes invented and patented by me in 1857, fairly and entirely fulfils all these conditions. In the first place it was designed expressly for application to any ordinary description of railway carriage, van, or truck, and its action is so immediate and powerful, that by its means a train of carriages may be stopped in a much shorter distance than 300 or 400 yards mentioned by Captain Galton. In the next place, the construction and arrangement of my apparatus is such, that it needs no adjustment whatever, however much the brake-blocks or frictional surfaces may wear. In the third place, my system is so devised, that carriages fitted with it may be interchanged, or turned round, in any or every conceivable manner without in any way offering an obstacle to the making up of a train. Lastly, my apparatus may unquestionably be cheaply fitted—is of a very simple character—acts with perfect readiness and certainty—and entails no considerable labour or trouble upon railway servants.

These statements will not, of course, be accepted as true without proof. But I make them with all confidence, and am willing to furnish the proof when it is asked for. Meantime, I desire to urge the consideration of this question upon those to whom the limbs and lives of the travelling public are committed. If Captain Galton be correct in this matter—and who can doubt that he is?—then the neglect of an invention which can accomplish all that I have said mine can effect, amounts to nothing less than the neglect of the public safety, and the wanton exposure of the public to peril.

I have here endeavoured to state the matter fairly; and although in the absence of all adverse criticism I speak confidently of the merits of my

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apparatus, I believe I shall listen to such opinions as may be passed upon it, and such objections (if any) as may be brought against it, without prejudice or partiality. My sole objects are to draw the careful attention of railway officials to what I deem to be a life-saving invention, and to have it adopted if it be found all that I believe it to be. I would only say, in conclusion, that I consider I have now discharged my duty in connexion with this invention, and feel that I must henceforth leave those who are able to investigate it, and to adopt it, if it be really an efficient system, to do theirs.

This apparatus consists of a square sliding bar,* suspended under each carriage, the connexion being made by a universal joint coupling,† so as to render the break continuous throughout the train, thus making it possible to apply three or four brakes simultaneously. In making up a train, the brake-blocks of the brake-vans are screwed up close to the rims of the wheels, and then the coupling is effected so as to avoid the possibility of slack. The brake-blocks are so arranged on the carriages that two operate in each direction, so that the carriages may be moved either backwards or forwards indiscriminately; but this is not the case with those attached to the tenders and the break-van. There is a worm-wheel on the spindle of the handle from the van, working into a cog-wheel loose on the longitudinal shaft. On this shaft there is a screw working in a loose collar, to which are attached the ends of one pair of levers, working the arm of a lever, on a fixed shaft, also carrying the lever to which the blocks are attached.—(See Minutes of the institution of Civil Engineers, 23rd November, 1858; *Mechanics' Magazine*, 24th April, 1858; The *Engineer*, 10th Dec., 1858.)

I am, gentlemen, yours obediently,

WALTER HALL.

Erith, 20th July, 1859.

ELECTRIC TELEGRAPH CABLES.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Having received several letters from Mr. J. Hearder, of Plymouth, in reference to his patent for constructing telegraph cables, he therein attempts to lay claim to that which the public *has a right*, viz., the covering of copper wire with cotton or other fibre, previously to covering it with india-rubber or gutta-percha. We find in your journal of September the 4th, 1858, page 220, Mr. Hearder's specification of his patent. "First, he covers the conductor with cotton, silk, wool, hair, flax, or other porous substance or substances, in any of their forms, in one or more layers, previously to coating it with the insulating material, which may be india-rubber, gutta-percha, or any of their compounds, or any other insulating composition; or, secondly, he coats the wire with the insulating material." We are prepared to show that this has been done at least ten years ago for telegraphic purposes, and as a proof we have sent him a specimen. Mr. Hearder's *specification further states that he* "then applies any of the before-mentioned porous or fibrous substances over the insulating material; or, thirdly, coats the conductor with the fibrous, porous, or textile material in the manner described in the first process, and then applies the alternations of insulating and fibrous materials in the manner described in the second process," We give Mr. Hearder credit for this part of his invention, at the same time we believe, as practical men, the insulation would not remain perfect for any considerable length of time for deep sea cables; added to which he would find some serious difficulties to contend against in the manufacture of cables so constructed.

We cannot follow Mr. Hearder through such a multiplicity of ideas as to the construction of a cable under his patent, as it would be simply a waste of time. We find in page 221 the following ambiguous statement of carrying out his invention:—"In all cases I recommend the employment of a soft, adhesive, insulating medium, which shall adhere to the fibrous material as well as to the surface of the more solid insulating substance used for the several coatings, in order to prevent the layers from sliding over each other." We must confess that we are somewhat puzzled to understand how this part of his invention is to be accomplished, as Mr. Hearder does not explain. Does he mean wax of any sort? as we should very much like to know what he really intends to use, for we are quite sure he cannot carry out his invention if he is not in a position to state what the "soft insulating medium" is, so as to adhere to the "surface of the more solid insulating substance." Perhaps it would be better to state for Mr. Hearder's information, that gutta-percha will not adhere to india-rubber or cotton to the extent required for submarine cables; the reasons are obvious to those "practically acquainted" with the use of these gums. "I am aware," says Mr. Hearder, "that wire has been coated with fibrous or textile substances to effect the adhesion of the insulating materials, which would not adhere sufficiently to the wire without them." How could Mr. Hearder, upon making this admission, lay claim to it as his invention? We therefore repudiate such a *monstrous claim*, as to whether it would assist the insulation or otherwise.

We beg, therefore, to state on public grounds, that "*no part*" of Mr. Hearder's invention is essential in constructing cables under our patent; in fact, we see not the least advantage to be derived from it. We believe, as Mr. Hearder states, that gutta-percha is not the best insulator for submarine cables; we are also of opinion, if he had been in possession of the properties of "*pure india-rubber*" as an insulator, and had known the practical method of applying it for insulation, he would not have attempted to construct such a cable as his on "*theory*" apart from all the "*mechanical difficulties*" he would have to contend against. We are, Gentlemen,

Yours most obediently,

HALL AND WELLS.

Steam Mills, Mansfield-st., Borough-road,
18th July, 1859.

THE GREAT RAM.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I take the liberty of leaving for your inspection a model of an elongated steel bolt, having two longitudinal wooden wings and a latitudinal wooden bolt passing through its diameter near the base, forming two well-defined "tetons" on either side. The bolt is poised on these four wooden supporters, so that the body of the bolt cannot abrade on the interior of the rifle, whether rifled cannon or small arm. I should like to try an experiment with a well-tempered steel bolt, formed on this principle, against the iron sides of the great steam ram, when quite finished at a cost of £300,000; the experiment to be made from a long 68-pounder brass cannon, rifled with four grooves, the length of the bolt to be two and a half diameters of the base of the gun; the front face of the bolt to be slightly cupped, after the manner of a steel punch—this experiment being made when the ram is quite finished, will be the more interesting to the public who pay the cost.

I remain, Gentlemen, your obedient servant,

J. NORTON.

NOTE.—Mr. Lancaster has shown me a new compound metal of the bronze nature, which is very tensile, not corrodible, and is therefore well adapted for rifle cannon.

Rosherville, 30th July, 1859.

Law Case.

COURT OF CHANCERY, Lincoln's-Inn, June 29.—(*Before Vice-Chancellor Sir J. Stuart.*)

CLARK'S PATENT BOAT-LOWERING BLOCKS.

CLARK V. FERGUSON.

This was a motion for an injunction to restrain the defendants from manufacturing or selling any blocks made according to or in imitation of the mode described in the plaintiff's specification, and from infringing the plaintiff's letters patent, and from using the invention of the defendant, James Nash, without the leave and license of the plaintiff, and from proceeding with an application for the grant of letters patent to the defendant James Nash. The plaintiff's case was that in April last he had obtained letters patent for an improved safety block, to be used in lowering ships' boats and other analogous purposes, and that before filing his specification he had employed the defendants, Messrs. Ferguson, who were blockmakers at Millwall, to construct blocks for him according to his invention. In the progress of such manufacture the defendant, James Nash, who was the foreman of Messrs. Ferguson, invented an improvement on the plaintiff's invention, and the defendants thereupon proposed that such improvement should be introduced into the specification which was about to be filed, and that in consideration of such improvement they should be allowed a share of the profits to be derived from the plaintiff's patent. The plaintiff not having acceded to the defendants' proposal, he alleged that they thereupon threatened to manufacture blocks according to the alleged improved mode discovered by the defendant Nash, and thereupon he filed this bill, on the ground that Nash's block was only a colourable variation from his. The plaintiff's invention consists of a certain combination of mechanism, whereby, by means of an eccentric hook attached to the bottom of the lower blocks of a boat's tackle, the boat can be freed from the tackle by which it has been lowered immediately on touching the water.

Mr. Bacon and Mr. Freeling appeared in support of the motion.

Mr. Malins and Mr. Druce, for the defendants, said that they were willing to give an undertaking not to use the plaintiff's patent, or that the motion should stand over with liberty to the plaintiff to bring such action as he might be advised.

The Vice-Chancellor said this was not the ordinary case of the infringement of a patent, but the litigation arose in consequence of the plaintiff not having acceded to the defendants' proposal to embody in his specification Nash's improvement. It was in the discretion of the Court as to whether it would impose on a patentee the necessity of bringing an action to establish the validity of his patent, and he did not think that that was a case in which he should make any such terms; for it was only as an after thought, and after the plaintiff had declined to accede to the defendants' proposal, that the defendants called in question the plaintiff's invention. The plaintiff was entitled to an injunction restraining the defendants from manufacturing or selling any blocks made according to, or in imitation of, the mode described in the plaintiff's specification, and from infringing the plaintiff's letters patent; but there would be no order to prevent the defendants from using Nash's invention, or from applying to the Attorney-General for a patent for Nash's improvement.

* This longitudinal bar enters the square sockets of the universal joints, and is of such a length that when the train is extended to its greatest length, it will not be withdrawn from its sockets. Upon this bar is placed a shoulder, which is set fast by a set-screw, and on either side of this shoulder is placed a helical spring, which bears against the plates that support the longitudinal bar, and offers a certain amount of resistance to the motion of the bar in either direction. In the event of a concussion taking place upon the train or between the parts of the train, these springs will receive the shock gradually, and prevent, or aid in preventing injury to the train. By placing pins through the several bars or shafts within the universal joints, the said shafts and joints would act as couplings, and keep the carriages connected in the event of the ordinary connexions giving way. With this arrangement guard chains might be dispensed with.

† This coupling has two centre pins, which pass through the hollow centre-piece, so that when either of them is removed the joint becomes detached. This hollow centre-piece is a coupling to the apparatus, whenever the same is fixed to any part of the train, provided the universal joints are all of the same principle in the construction.

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Parliamentary Proceedings.

HOUSE OF COMMONS.

JULY 28, 1859.

TELEGRAPHIC CABLES.

Sir W. P. GALLWEY asked the Secretary to the Admiralty whether any and what experiments were proposed to be made as to laying telegraphic cables in deep water, before risking the sum voted for a cable to Gibraltar.

Lord C. PAGET replied that experiments were now in progress, under the superintendence of the Board of Trade, and under the control of those eminent engineers, Mr. Stephenson and Sir C. Bright, with the view of testing the composition of the outer coverings of telegraphic cables.

RIFLING OF CANNON.

Sir H. VERNEY asked the Secretary of State for War whether any steps were being taken, and what, for the rifling of the smooth-bored iron cannon in store for the supply of the army, navy, and forts in the interval that must elapse before a sufficient number of Armstrong guns can be manufactured.

Mr. S. HERBERT said the Government had authorized experiments to be made in rifling the ordinary iron guns, and one gun would be tried next week. Similar orders would be given at the factory at Woolwich, and he hoped soon to see from 15 to 16 iron rifled guns produced per week.

COINAGE.

Leave was given to Mr. LAING to bring in a Bill to extend the enactments relating to the copper coin to coin of mixed metals.

The Bill was read a first time. It has since been carried forward through various stages.

JULY 29, 1859.

GAS IN BARRACKS.

Mr. BRADY asked the Secretary of State for War whether it was the intention of the Government to adopt gas in lieu of the present mode of lighting the military camp at Aldershott; and, if so, would the Government construct their own works.

Mr. S. HERBERT said it was the intention of the Government next year to introduce gas into barracks, and to construct works for that purpose, but they did not intend to introduce gas into the camp.

Proceedings of Societies.

INSTITUTION OF MECHANICAL ENGINEERS.

The general meeting of the members of this Institution was held on Wednesday, the 27th ult., at the house of the Institution, Newhall Street, Birmingham; Joseph Whitworth, Esq., Vice-President, in the chair. The Secretary (Mr. W. P. Marshall) read the minutes of the previous meeting, and several new members were elected. An abstract was read of a paper "ON THE CONSTRUCTION OF HOT-BLAST OVENS FOR IRON FURNACES," by Mr. Henry Marten, of Wolverhampton, the discussion of which was adjourned from the previous meeting.—Mr. Neilson gave an interesting account of the circumstances under which the idea of hot-blast first occurred to him, and his early experiments in the practical application of the plan to iron furnaces. If made from equally good materials the hot-blast iron was found to be as good, he said, as cold-blast, and some of the strongest castings had been obtained from judicious mixtures of hot-blast irons.—Other speakers expressed the same opinion, and commented upon a recent report by Government Commissioners upon the marine engines of the navy, in which it was proposed to exclude the use of hot-blast iron in their construction; and considered such a proposal was not based upon sufficient investigation of the subject, and was directly opposed to the results of general experience. The next paper was "ON THE APPLICATION OF THE DECIMAL SYSTEM OF MEASUREMENT TO MECHANICAL ENGINEERING WORK, &c.," by Mr. John Fernie, of Derby.

The following letter may deserve a line or two of space:—"Gentlemen,—I observe that my directors are inviting the inventive world to send in to them all the plans and designs ingenuity can suggest for laying me successfully in my ocean home. To this I have no objection, but I cannot help suggesting that it is only due to myself that, as in all other great competitions, some respectable premium should accompany the invitation, and be offered by my managers and directors whose right to speculate on the inventive ingenuity of the public I for one repudiate most sincerely, ATLANTIC CABLE."

Our Weekly Gossip.

A series of experiments is about to be conducted by Captain Galton on the part of the Board of Trade, Mr. R. Stephenson, M.P., and Professor Wheatstone, to determine the best description of cable for the proposed line of telegraph from Falmouth to Gibraltar. The experiments are to be carried on with the aid of the Atlantic Telegraph Company, and will comprise an investigation into the comparative value of gutta-percha and india-rubber, the best mode of insulation, and other questions connected with the manufacture of deep submarine lines.

The following are the main provisions of a Bill, prepared and brought in by Mr. Laing and Mr. Chancellor of the Exchequer, and now in progress through Parliament, "to extend the enactments relating to the copper coin to coin of mixed metal." When any coin of bronze or mixed metal shall be current by virtue of any Proclamation that may be issued by Her Majesty, all the penalties and provisions of the Act of the Session holden in the second and third years of King William the IV. "for consolidating and amending the laws relating to the coin," which are applicable to the current copper coin, or offences or acts relating thereto, shall be applicable to such current coin of bronze or mixed metal or the like offences or acts relating thereto; and sections twelve and fourteen of the said Act, and all other provisions of such Act, and all enactments whatever where current copper coin is mentioned, shall be construed and take effect as if in addition to copper coin, current coin of bronze, or mixed metal, had also been in any such case mentioned or referred to.

At the last meeting of the Institution of Mechanical Engineers at Birmingham, Mr. Whitworth exhibited his fine measuring machine, used for making standards of length, in which the bar to be measured is placed horizontally between the two end surfaces of the machine, a thin flat piece of iron called the gravity piece being introduced between the bar and the end screw of the machine; the screw is advanced and brought into contact with the gravity piece until the latter is only just able when raised to fall again; and by then advancing the screw only one-millionth of an inch further, the gravity-piece remains suspended between the two surfaces: thus one-millionth of an inch is rendered distinctly apparent, and standards of length are obtained by the machine with perfect correctness to the millionth of an inch by repeating the same process with corresponding bars. Mr. Whitworth also showed a set of standard plugs for the decimal wire gauges, and specimens of the gauges manufactured from these standards by Mr. Peter Stubs, of Warrington. Some of the decimal rules, twenty and thirty inches long, now in use in the workshop, were also exhibited, made by Mr. Sampson Aston, of Birmingham, from Mr. Whitworth's standard.

The editor of the *Athenæum*, in his last number, says:—"A few days ago we saw the range and accuracy of the new Armstrong gun tested in a way which demands a note. Cooling ourselves on the Essex coast, near the artillery practising ground, we were asked to see the firing, and while this goes slowly and solemnly on one of them spies a flight of geese far out to sea. 'There, they light on yon sandbank.' Up go a dozen glasses. Yes; there they flicker in the sun, gray and white, mere specks in the blue sea air. Load the gun—load at the breach—poise—touch—bang! Boat off there to the sands! A signal tells the tale. The shot has struck the swarm—a life is taken from the flight—and this at six miles seven furlongs from the mouth of the gun! A shot as well aimed from Primrose-hill should hit the ball on Greenwich Observatory, or, if fired from Richmond Park, should bring down a rider in Rotten-row. Here is a fact worth the attention of those Austrian engineers who have just come to London to study our new artillery and learn how to defend Verona against the Frank." We confess we are "cynical" enough to disbelieve this curious statement as it stands. Isn't there a mistake as to the animal? Have we not here the hit of a *canard* rather than the hitting of a goose?

The impossibility of rendering a strong box altogether safe against theft by means of skeleton keys has led a locksmith in Frankfort-on-the-Main to hit upon the ingenious idea of constructing a strong box without any keyhole at all, and which even the owner himself cannot open. Why, what's the use of such a box? you will ask. But, observe, inside is a clockwork, the hand of which the owner places at the hour and minute when he again wants to have access to the box. The clockwork begins to move as soon as the lid is shut, and opens the lock from the inside at the moment which the hand indicates. Time, dependent upon the owner, is the key to the lock—a key which can neither be stolen from him nor imitated.

Lieut. Col. G. W. H. Ross, of the Rifle Militia, writing from Jersey to the *Times* says:—"Having observed that the Duke of Somerset has stated in answer to Lord Lyndhurst that no authentic information has reached him of the employment of rifled cannon in the French navy, I beg to say that when I visted Cherbourg, in the month of March last, I saw a number of new rifled cannon (ships' guns) lying on the quay, close to the Arsenal. They were of the two grooved pattern, recently introduced by the Emperor into the French army."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 2868, 2894, 2897.
BOILERS AND THEIR FURNACES. *None.*
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2869, 2893.
SHIPS AND BOATS, including their fittings, 2874, 2892.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2875.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals. *None.*
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2873, 2887, 2899, 2904.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c. *None.*
LIGHTING, HEATING, AND VENTILATING, 2900.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2890, 2898, 2905.
METALS, including apparatus for their manufacture, 2879, 2881, 2883, 2895.
CHEMISTRY AND PHOTOGRAPHY. *None.*
ELECTRICAL APPARATUS, 2884, 2888, 2891.
WARFARE, 2871, 2885, 2896.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 2870, 2872, 2876, 2877, 2878, 2880, 2882, 2886, 2889, 2901, 2902, 2903, 2906.

2868. D. ROWAN. "Improvements in steam-engines." Dated Dec. 15, 1858.

In one arrangement provided by this invention, which may be called the "inverted duplex cylinder design," and which is suitable for driving a screw-propeller, an inverted cylinder is placed on a suitable framing directly over the shaft, and this cylinder has a similar one placed (by preference concentrically) within it, together constituting what is herein termed a duplex cylinder, which comprises a central cylindric a space surrounded by an annular space; pistons working in these two spaces are connected by their rods, which pass out through the bottom covers to one cross head, a connecting rod or rods passing thence to a crank on the shaft. The fresh steam from the boiler first enters the central cylinder, next passes thence to the opposite end of the annular cylinder, and finally passes from the annular cylinder to the condenser. A complete set of engines comprises two or more duplex cylinders connected to different cranks in the usual way. There are several modifications given in the specification of this invention, including an arrangement for operating the valves. *Patent completed.*

2869. H. BRIDGES. "Improvements in the means of working brakes on carriages on railways." Dated Dec. 15, 1858.

Here the inventor places under each carriage in a horizontal position, and extending the whole length of such carriage, a screw shaft having on the screw part thereof a wormed nut, connecting rods being attached at one end to the nut, and at the other to a lever or wheel. On the same shaft a toothed bevil wheel works into another toothed wheel on a vertical shaft, therefore when this vertical shaft is moved round, it will by the toothed bevil wheels cause the screw shaft to revolve, and the nut being restrained from revolving with the screw shaft, will traverse or move longitudinally along the screw shaft, and carry with it the connecting rods, and thereby actuate the brake against the rails. *Patent completed.*

2870. F. C. N. J. MIGEON. "Improvements in manufacturing screws, rivets, nails, spikes, and all similar articles made of metallic wire, and in the machines connected therewith." Dated Dec. 15, 1858.

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This includes a whole set of new machines for performing the operations, which are four in number, and consist, 1, in heading or upsetting; 2, in turning the head; 3, in nicking the head; 4, in cutting the threads. Each of the above-mentioned is performed by a different machine, and there is also a feeding apparatus. *Patent completed.*

2871. A. V. NEWTON. "Improved machinery for manufacturing bullets." (A communication.) Dated Dec. 15, 1858.

This relates to an arrangement of machinery in which a punch and set of dies for pressing blanks or pieces of lead into a form approximating to that desired for the bullets, are combined within a revolving core, which serves, firstly, to produce a central cavity when that is required in the bullets, and secondly, as a mandril to revolve the bullet, for finishing their exteriors by the operation of turning. The invention also consists in the use of an automatically operating cutter in combination with the revolving core for turning the bullets. It also consists in the use in combination with the revolving core of a centre piece having an automatic operation for confining the bullets upon the revolving core during the turning operation, and afterwards releasing them and moving out of the way to permit the succeeding operations of the dies. *Patent completed.*

2872. A. V. NEWTON. "An improved arrangement of condensing apparatus." (A communication.) Dated Dec. 15, 1858.

This relates to a novel construction of condenser, in which a series of parallel vertical cells or flat tubes are used to receive the steam to be condensed. These cells or steam chambers are enclosed within a steam tight metallic cylinder casing, leaving between and around them a space for the circulation of water. At their upper part the chambers are connected by pipes with the exhaust steam supply pipe, and in like manner at their lower end with a pipe leading to an exhaust pump. The water of condensation is drawn from these chambers by this pump, and forced into the case surrounding the condensing chambers. This case or cylinder is connected at its upper part by pipes with the steam boilers. As, therefore, the condensed water thrown into the cylinder circulates round the condensing cells or chambers, it becomes heated by extracting the heat therefrom, and thence passes upwards to the boiler. *Patent completed.*

2873. J. BULLOUGH. "Improvements in looms." Dated Dec. 15, 1858.

The required motion is here given by any suitable number of healds for forming the shed according to the desired patterns by attaching them to cords passing over guide pulleys, which cords are connected to other cords, wires, or rods in a horizontal position having collars, knobs, or hooks upon them. At the top or other convenient part of the loom one or more rocking or oscillating shafts are worked for giving an oscillating motion or sliding movement to one or more bars, plates, or knives, so that when the horizontal cards, wires, or hooks are pressed on their tops by pegs on a pattern cylinder or lattice, the knobs or hooks shall either be put on or taken off the bar or bars, and thereby raise the healds or leave them free according to the bend of the hooks. *Patent completed.*

2874. C. F. VASSEROT. "An improved pendulum governor for regulating the supply of steam to the cylinders of marine engines." (A communication.) Dated Dec. 15, 1858.

This consists of a pendulum, which, by means of a guide and rollers, vibrates only in a plane, parallel and coincident with that of the axis of the ship. By means of one or more arms, the pendulum is connected with a vertical spindle, which has a screw tapped on its upper end. Upon the screw is placed a muff, having a small fly-wheel attached to it, and which is kept from moving upwards by a ring placed above it, and held by a set screw. Attached to the muff, by a strap and pins, and stretching in a direction at right angles to the last-mentioned screw spindle, is another spindle or arm having its extremities made of a forked or gimbal form, and having cut on its centre a right and left handed thread over which a union or junction having similar threads cut upon it works, so that by turning the union to the right or left this spindle is lengthened or shortened. The other extremity of this forked spindle is attached to a muff similar in every respect to the first described one, and mounted upon another spindle or rod, having its one extremity formed as a screw, the other attached to and vibrating with the axle of the throttle valve of the steam pipe. *Patent completed.*

2875. W. CLARK. "Improved agricultural implements." (A communication.) Dated Dec. 15, 1858.

This relates to farming implements, having for their object to open up and stir and break up the sub-soil after the passage of a plough through the ground without mixing the earth of the subsoil with the upper layer of arable ground. A hopper placed in front of the implement permits of a certain quantity of lime being dropped into the furrow of the plough to be mixed with the subsoil. *Patent completed.*

2876. J. WARDILL. "An improved stopper or controller, to stop and control the running out of chains and ropes." Dated Dec. 15, 1858.

This consists in constructing a stopper or controller with hinged jaws, one being hinged to each side of a bed along which the chain or rope runs, and which jaws, by means of a screw lever or other suitable power applied at or near the upper part thereof are made to press down upon, grip, and entirely or partially stop the passage of the chain or rope. *Patent completed.*

2877. G. BELL. "An improvement in matches and fuses." Dated Dec. 15, 1858.

This consists in the use of a metal shaft which is dipped in any igniting composition suitable to the purpose for which the match or fusee is intended. The composition will be found to burn upon and adhere while burning to the metal shaft. *Patent abandoned.*

2878. T. Moss. "Improvements in printing bank notes, bills of exchange, and other documents, requiring like security against being copied." Dated Dec. 15, 1858.

Here the paper on which a bank note, &c., is to be printed is coated with colouring matter. The colours preferred are yellow, red, brown, or green, and the colours are so prepared that they cannot be removed by any chemical agency unless the paper be destroyed. Burnt clay or carbon is used in compounding the colours, and they are mixed with drying oils or varnishes and are applied by blocks or otherwise. *Patent completed*

2879. W. MORGAN. "Improvements in the manufacture of iron." Dated Dec. 15, 1858.

This relates to the smelting iron ores in which the quantity of alumina present is equal to or exceeds one-half the quantity of silica, and the invention consists in employing as a flux in the blast furnace when smelting such ores sandstone, sand, or other matter containing silica in a comparatively pure form, that is to say, at least 75 per cent. of that substance. *Patent completed.*

2880. R. and R. WILSON. "Certain improvements in the preparation of leather in combination with india-rubber and other materials, for the manufacturing of hose-pipes, and other purposes where leather is required to be impervious to water, steam, or frost." Dated December 16, 1858.

Here the inventors take leather of suitable thickness and strength for hose pipes and for other purposes where the article is required to be impervious to or to resist action of steam, hot-water, or frost, and first thoroughly cleanse the same by scouring in cold water; the inner surface is then shaved evenly to the thickness required and a layer of dubbing composed of oil and tallow is applied to it, and it is hung up until the dubbing is well absorbed. The outer grain of the leather is then taken off with a currier's knife, and the leather is punctured by a roller the surface of which is set with small spikes or teeth. A solution of india-rubber combined with shellac is then applied to the surface of the leather, which enters into and is retained by the small punctures and grain of the leather. A thin layer of india-rubber solution is then applied, which serves as a foundation to receive a covering of vulcanized india-rubber cloth. The combined sheets of leather and india-rubber are then stretched upon a drum so as to cause the india-rubber to adhere firmly to the leather, and when this is accomplished the outer surface of the leather (previously punctured) has a coating of the india-rubber solution applied thereto. *Patent completed.*

2881. W. H. CARMONT and W. CORBETT. "An improved mode of constructing furnaces for the production of wrought-iron and steel, and manufacturing such metals into ingots and other forms." Dated Dec. 16, 1858.

Here the flues are so constructed as to rise perpendicularly from the grate, thereby carrying off all the deleterious gases generated, and preventing such gases coming in contact or becoming incorporated with the metals so manufactured. The heat is also caused powerfully to reflect and reverberate upon the metals, at the same time preventing all flame or smoke passing over or coming in contact with the metals whilst in a heated or smelting state. *Patent abandoned.*

2882. A. and J. STOKES. "New or improved machinery for the manufacture of screws." Dated Dec. 16, 1858.

Here the machinery effects the opening and closing of the dies or cutters by which the worming and turning of the screw is effected, and also throws the lathe out of gear with the driving power without the intervention of an attendant. *Patent completed.*

2883. R. MUSHET. "A new or improved manufacture of cast steel." Dated Dec. 16, 1858.

This consists in manufacturing cast steel from cast iron which has been wholly or nearly decarbonized by passing air through it while it is in a molten state, the conversion of the iron into cast steel being effected by melting the same and treating it whilst melting or when melted with a triple compound or mixture consisting of or containing iron carbon and manganese. *Patent completed.*

2884. J. H. SELWYN. "A novel apparatus for paying out or laying down submarine telegraph cables or wires, and for raising the same after they have been laid down." Dated Dec. 16, 1858.

This invention is described at pages 123 and 155 of the MECHANICS' MAGAZINE (new series). *Patent completed.*

2885. J. W. EDGE. "A certain improvement in balls, bullets, or other projectiles to be employed in fire-arms or ordnance." Dated Dec. 16, 1858.

Here the projectile is of that description which is partially hollow, and the invention consists in filling such cavity with a composition of wax and tallow, and in so perforating the sides of the projectile that upon the explosion of the powder such lubricating material may be forced through the apertures and effect the lubrication of the barrel. *Patent completed.*

2886. J. W. FRIEND. "Improved apparatus for ascertaining and registering the depth and flow of liquids and the distances run by ships at sea." Dated Dec. 16, 1858.

This consists in enclosing within an outer case tangent tooth and pinion gear in connection with a fan or paddle wheel by which the resistance caused by the water impinging upon the floats or paddles may be correctly ascertained, and corresponding results registered by graduated wheel plates or dials presenting the numeral or scale corresponding to the said resistance. For ascertaining the depth of water at sea, the speed or distance run by vessels, or the amount of fluid otherwise passed through the apparatus, the said apparatus when employed for ascertaining the distance run by vessels being provided with metallic wings or blades presented obliquely to the water, by which the instrument is kept constantly submerged, and when used for registering the flow of liquids furnished with concentric slot openings formed eccentrically in the channel in which the fan or paddle wheel revolves, through the medium of which the water, &c., is directed against the floats or paddles. *Patent completed.*

2887. A. MACKENZIE. "Improvements in sewing machines." Dated Dec. 16, 1858.

Here, according to one portion of the invention, the circular needle machine is referred to, the sewing or stitching action being effected by the combined action of a straight needle of vertical action, and a curved needle of horizontal action. The framing of the machine is generally similar to that already in use, consisting of a rectangular table frame, open beneath, and formed with a platform top for the working operation. *Patent abandoned.*

2888. J. J. MARCAIS. "Improvements in galvanic batteries." Dated Dec. 16, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2889. W. WHITE and J. PARLBY. "Improvements in the preparation or treatment of 'carton pierre,' and such like composition, and in the application thereof to the coating or covering of walls and other surfaces." Dated Dec. 16, 1858.

This relates in mixing with "carton pierre," &c., material adapted to resist moisture, such as pitch, tar, rosin, gutta-percha, india-rubber, or resinous or bituminous substances of a like nature, or of cement in powder used with the "carton pierre," either alone or in combination with the above-named materials. It also relates to the application of such matters as a covering for surfaces and partitions of buildings, &c. *Patent abandoned.*

2890. R. A. BROOMAN. "An improvement in plating and gilding forks, spoons, and other metal articles." (A communication.) Dated Dec. 16, 1858.

This consists in plating those portions of the forks, spoons, &c., which are subjected to more wear than others, such as the prongs of forks and the bowls of spoons, with a thicker coating than the other portions. The patentee takes any article which has been uniformly coated by the aid of the galvanic bath, and heats it, and by affinity of metal for metal solders on to those parts requiring a thicker coating as many layers of leaf silver or gold as may be necessary to produce the desired thickness. *Patent completed.*

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2891. W. CLARK. "Improvements in submarine electric telegraph cables or conductors." (A communication.) Dated Dec. 16, 1858.

Round a cord of elastic material, which may be either a conductor or non-conductor, the inventor winds a copper wire, for example, in contiguous spirals, as in covered springs for musical instruments, &c.: over this he again winds another wire of about the same diameter, so that this second helix falls in the furrows of the first. He obtains thus a conductor composed of an elastic cord placed in the centre of two spiral superposed coils in which the spirals are wound so as to insure contact whatever may be the extension they suffer; for in proportion as the elastic core stretches, the exterior pressure causes the external spirals to bear on the spirals of the inner helix and forces them in the intervals of the spirals of the inner helix. *Patent completed.*

2892. J. J. ASTON. "Improvements in machinery or propellers applicable for the propulsion of ships, boats and other vessels on and through the water, and in the propelling of all such vessels on and through the water by means of such propellers." Dated Dec. 17, 1858.

These propellers consist of solid circular discs or rollers mounted on a central axis, and made of wood, metal, or wood and metal combined. They are flat at the sides, and have no floats, paddles, or projections on their plane peripheries. *Patent completed.*

2893. W. J. JOHNSON. "Improvements in machinery or apparatus for preparing for joining the rails of railways." Dated Dec. 17, 1858.

This relates, 1, to a method of cutting the rails so as to obtain correct lengths. For this purpose the inventor employs a portable apparatus constructed with a cutting tool to which a reciprocating motion is imparted. This tool is caused to reciprocate by an eccentric, and the traverse for the cut is gained by suspending the tool upon a centre, in which it is caused to swing. It relates, 2, to apparatus for making fish joints, and consists in combining the above described cutting apparatus with a drill or drills, so that the two operations may proceed simultaneously. It also consists in using a combination of two or more drills without the cutting tool, so that the like number of holes may be drilled at the same time. *Patent completed.*

2894. J. and J. INSHAW. "An improvement or improvements in locomotive engines." Dated Dec. 17, 1858.

Here the inventors place a friction wheel between the driving and leading wheels, and another friction wheel between the driving and trailing wheels, the said friction wheels being so situated that by a slight motion of their bearings they may be brought upon the peripheries of the driving and leading wheels and the driving and trailing wheels respectively of the locomotive. The leading wheels or trailing wheels or both are thus geared to the driving wheel, and receiving motion therefrom, facilitate the advance of the locomotive by their adhesion to the rails. The friction wheels may be brought into contact with the driving and leading wheels and trailing wheels, either by the action of a piston rod that is worked by a steam cylinder or otherwise. *Patent abandoned.*

2895. A. HINDE. "Improvements in treating or preparing the cinder or slag from puddling furnaces for the purpose of facilitating the manufacture of iron therefrom." Dated December 17, 1858.

This consists, 1, in calcining puddling furnace cinder, or slag, when used for the smelting of pig or cast-iron by performing the process in kilns built with flues, or external fire-places, similar in construction to those now used for the production of what is technically known in iron forges as "bull-dog," and in using the puddling furnace cinder or slag when so calcined in the blast furnace for the production of pig or cast-iron. It consists, 2, in mixing with puddling furnace cinder or slag previously to calcination, lime or limestone, and calcining the same in admixture with the cinder for purifying the said cinder, or assisting the subsequent process of smelting in the blast furnace. *Patent abandoned.*

2896. J. KEER. "Improvements in the construction of revolving fire-arms." Dated December 17, 1858.

Here the inventor is enabled to apply the ordinary gun-lock and cock with the usual safety bolt to revolving fire-arms. The lock is pulled off by the trigger blade in the usual manner, but by having an extra "bent" in the tumbler the lock can be snapped and cocked by simply pulling the trigger, for which purpose the inventor uses in conjunction with the extra bent above referred to a short lever in the trigger, which is kept in the proper position by a hook formed on its edge, and a stud on the top of the tumbler. The chamber is rotated in the ordinary way. It revolves on a rod or spindle inserted into its place from behind, or from the front, and is adjusted or tightened up when necessary by an adjusting tube or nut, tapped into the base of the cylinder. The lever rod has no working fulcrum of its own, but it is curved at the heel, and such curved portion works between two fixed stud pins so that a moving axis is obtained, which axis is the point of junction with the plunger; by this arrangement no pins or slots are required in the lever. *Patent completed.*

2897. J. CLEGG. "Improvements in lubricating the valves and pistons of steam-engines." Dated December 17, 1858.

Here the lubricating apparatus is so formed that the oil, &c., is placed in a cup or vessel fixed above the steam-pipe leading from the steam boiler to the cylinder of the engine. Below the cup or vessel into which the oil, &c., is placed there is a cock, when the plug of which is turned the oil, &c., will pass downwards towards a vessel of a spherical or other form, at the upper part of which vessel a valve is applied which closes the passage into the vessel when pressed upwards by steam in the vessel. At the lower part of the vessel a valve is applied which opens upwards when pressed on by the steam below. The spherical or other formed vessel is connected to the steam-pipe by a tube on which there is a cock, so that when the plug thereof is turned the oil, &c., will flow out of the spherical vessel into the steam-pipe, and be carried onward by the steam to the valve or valves of the engine, and to the piston working on the steam-cylinder. *Patent completed.*

2898. J. KETCHUM. "Improvements in the method of roasting meat, poultry, game, by basting the same, and in the method of manufacturing the necessary apparatus for so doing." Dated December 18, 1858.

This consists of a perforated vessel which is to be suspended below the bottle-jack, or other roasting contrivance by hook, eye, or spindle, which hook, eye, or spindle projects above the said vessel so that it may hang steady, and the vessel being supplied with grease it will pass through the perforations and fall on the joint, &c., being roasted. The invention also includes an arrangement for raising the fat, &c., from a lower level into the aforesaid baster. *Patent completed.*

2899. J. AITKEN and J. BROOKS. "Improvements in looms." Dated December 18, 1858.

Here the inventors employ a moving "back bearing rail" and give it motion by attaching to it one or more arms, each furnished with a block of wood, which blocks are in a line with one or both of the connecting links from the cranks to the sword-arms, so that as the links move up and down in their to and fro movement either one or both come in contact at certain intervals with the block or blocks, thus causing the rail to vibrate so as to maintain an equal tension of the yarn beam and consequent strain upon the yarn. Or they produce the same effect by placing on the crank shaft an irregularly-shaped cam or tappet which comes in contact with an arm or arms fixed to the "back bearing rail," thereby causing the latter to vibrate at the exact time required. In connection with the aforesaid movements they employ a stationary rod fixed across the loom for holding the yarn in the same relative position with respect to the moving "back bearing rail" and yarn beam. They employ at the back of each shuttle box a coiled spring to which is attached a strap, so placed as to receive the picker gently when throwing the shuttle. Each strap may be readily adjusted as required, and in connection with the spring forms a yielding check of great efficiency. They employ an elastic break by attaching leather, &c., to an arm or lever of sufficient strength, but capable of slightly yielding so as to temper the shock when the break acts, and also its mode of adaptation. For working the stop rod they employ an elastic swell, consisting of a spring of the same form as the present swell, thus lessening the difficulty of communicating motion to the top rod, and preventing the excessive strain upon the fingers and chisel in the event of trapping the shuttle and also diminishing the wear of the shuttles. *Patent completed.*

2900. J. MACKENZIE. "Improvements in those gas burners known as ventilating sun burners." Dated Dec. 18, 1858.

This relates to an improvement in ventilating gas burners, known as "sun" burners. These burners consist of a number of jets placed horizontally under funnels, or inverted cones, or chimneys of sheet iron, &c., and this invention consists in perforating or forming apertures in part of the inner funnel, pipe, or chimney, and also in part of the outer one, in order to allow the light to pass, and in filling up the openings with talc, mica, or other suitable transparent material. The shadow on the walls will thereby be prevented, and all parts of the ceiling will be equally lighted. *Patent completed.*

2901. A. MITCHELL. "Improved apparatus for registering the speed of engines and other machinery." Dated Dec. 18, 1858.

The object proposed to be effected here, in the case of an engine, for example, is the noting with a style or other marking instrument, upon suitably prepared paper, the number of strokes which it has made in a given time, using for this purpose the motive power derived from a clock or time-keeper, in combination with motive power derived from the engine whose performance it is desired to record. The way in which this combination of motive agency is to be applied may be varied—that is to say, the prepared paper may be carried under the style or marker by power derived from the engine, and the style or marker operated by the time-keeper, or *vice versâ*. *Patent completed.*

2902. J. TAYLOR. "Improvements in the construction of pumps or engines for lifting and discharging water." Dated Dec. 18, 1858.

This consists in the suction and discharge valves being combined within the same valve chest by two intersecting divisions or partitions through which the openings or passages are made between the suction and the discharge; these openings are covered by preference with flap valves which lie at a suitable angle, or are held against the respective faces of the partitional or divisional plates within the valve chest. The pumps may be single or double-acting barrels, and if two are used one should be placed on each side of the valve chest, and the suction and discharge openings or ways are common to both sets of valves; and the top and bottom parts of each barrel, in a double-action pump, would be connected with the same side of the suction chamber in the valve chest, and the air vessel should be placed above the valve chest, and may be so cast as to form the standard of the pump, or it may be attached to the valve chest. *Patent completed.*

2903. A. P. HOW. "Improvements in cocks or stop valves." Dated Dec. 18, 1858.

This consists in substituting for the ordinary plug-cock and the single station valve, a double bottom spindle valve (somewhat similar to the double beat valve) and in so constructing the shell of the cock or valve case as to form the two valve seats therein, and the inlet and outlet passages by covering the shell casting. *Patent abandoned.*

2904. E. WEBER. "Improvements in dycing or colouring textile fabrics and materials, and in the machinery or apparatus connected therewith." Dated Dec. 18, 1858.

This relates to a former patent, and consists in constructing the vessel into which the materials to be dyed are contained of a larger diameter as compared to its depth than that described in the specification of the former patent, by which means the height of the layer or column of material contained between the disc and false bottom through which the dye liquid is to be forced is greatly reduced, and consequently a more uniform tint is obtained, whilst a considerable reduction in the power required to work the force pumps is effected. *Patent completed.*

2905. J. SOUTTER. "Improvements in apparatus for drying or airing linen, or other articles of wearing apparel." Dated Dec. 18, 1858.

Here the linen airer consists, under one modification, of two plain or turned bars of wood disposed horizontally and connected by two horizontal bars, cut to the length the linen airer is desired. The two end bars are raised from the floor by knobs or feet. In each of the end bars two uprights are arranged parallel to each other; these uprights are connected longitudinally by cross rails made either plain or ornamental—these longitudinal rails serve as supports by placing linen thereon. Other supporting rails are obtained by securing to each pair of uprights a horizontal bar which extends outwards. Beyond the upper longitudinal rails short vertical pieces are connected to the extremities of the horizontal bars. These vertical pieces have fitted to them cross rails which form supporting bars, parallel with, but lower than, the upper longitudinal rails before described. *Patent completed.*

2906. J. H. JOHNSON. "Improvements in apparatus for re-working the waste steam of steam-engines." (A communication.) Dated Dec. 18, 1858.

The steam having operated in the cylinders is conducted by a pipe to a close vessel, in which it is allowed to expand and lose a great portion of its original pressure. From this vessel it passes to a surface condenser, which may be composed of a number of tubes surrounded with cold water tubes, and within which tubes the steam passes and is condensed, when it is removed by a lift and force pump, and supplied through a coil of pipes in one of the furnace flues to the boiler. By this means the steam is

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regenerated and its temperature is raised considerably before entering the boiler. The condenser is contained in a water tank, which receives the injection water, such water being heated by the steam, and used partially for supplying the trifling feed required to the boiler. To prevent the heating of the pump packing it is proposed to keep such packing moistened by a jet of water supplied from a small tank on the upper part of the pump. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated June 21, 1859.

1495. W. C. Fuller. Improvements in india-rubber shackles, and in springs for carriages, and the metal fittings connected therewith.

Dated June 23, 1859.

1512. G. C. Grimes. Improvements in cigar or such like lights, and in the means of producing them.

Dated June 29, 1859.

1546. T. Wight. Improvements in the apparatus used in the manufacture of cast metal pipes and castings, termed core bars or spindles and chaplets.

Dated July 5, 1859.

1595. C. Barlow. Improvements in capstans. A communication.

1596. A. Beaulieu. Improvements in crinolines, and in machinery for manufacturing springs for such and other purposes. A communication.

Dated July 6, 1859.

1604. C. Hagan. Improvements in apparatus for curing smoky chimneys, and preventing down draught.

1606. S. Lloyd. Improvements in the manufacture of cast steel tyres.

Dated July 7, 1859.

1616. J. Smith. Improvements in propelling ships and other vessels.

Dated July 8, 1859.

1634. W. N. Nicholson. Improvements in machines for making and collecting hay, and for cutting thistles and weeds, which improvements in whole or in part are applicable to other agricultural implements where teeth or tines are used.

Dated July 9, 1859.

1640. W. MacKean. Improvements in the manufacture or treatment of farinaceous matters for the obtainment of starch and food.

Dated July 12, 1859.

1651. J. Luis. Imitation leather. A communication.

1655. G. White. Improvements in apparatus for counteracting the effects of collisions in railway trains.

Dated July 13, 1859.

1657. C. S. Walker and R. Hoyle. Improvements in machinery or apparatus for promoting the consumption of smoke in steam-boiler and other furnaces, and for preventing the explosion of steam-boilers.

1658. A. Cooper. Improvements in the manufacture of the grips of swords, and sword boyonets.

1659. J. S. Thomson. Improvements in steam-engines. A communication.

1660. W. Cotton. Improvements in means or apparatus for connecting together or uniting looped fabrics.

1661. J. Combe. Improvements in machinery for hackling flax and other fibrous substances.

1662. J. Taylor. Improvements in stoves and fire places, and in the arrangement of flues connected therewith.

Dated July 14, 1859.

1663. W. Walker. Improvements in the manufacture of metallic packages, and in machinery for manufacturing the same. A communication.

1664. R. Mushet. Improvements in the manufacture of shot and shell and other projectiles.

1665. R. Mushet. A new or improved manufacture of certain metallic compounds or alloys.

1666. J. Atkinson. Improvements in fire-arms.

1667. J. H. Johnson. Improvements in the manufacture of artificial fuel. A communication.

1668. J. Morgan. Improvements in apparatus for making candles.

1669. J. Bailey. Improvements in machinery or apparatus for stretching woven fabrics.

1670. R. Longstaff and A. Pullan. Improvements in traction or locomotive engines.

Dated July 15, 1859.

1671. C. Kingsford. Improvements in the preparation of peat and charcoal for fuel, in the manufacture of coke therefrom, and in the machinery and apparatus employed for effecting the same.

1672. W. Clark and W. Williams. Improvements in finishing woven fabrics.

1673. F. Brown. The preparation and manufacture of a new fibrous pulp for making paper, and for other useful purposes.

1674. R. Mushet. New or improved methods of manufacturing a certain metallic compound or alloy.

1675. H. G. de Chateauneuf. An improved coverlet, called zephyr-cider-down coverlet.

1676. J. P. Farrar. Improvements in the treatment of iron.

1677. W. McAndrew and C. W. Boyd. Improvements in treating poppies, to obtain a product resembling opium therefrom.

1678. W. O. Carter. Improvements in machinery for sawing slate.

1679. F. Prince. An improvement in breech-loading fire-arms.

Dated July 16, 1859.

1680. J. Musgrave, jun. Improvements in the construction of steam-boilers.

1681. J. Bernard. Improvements in the construction and arrangement of hydraulic and other pumps, for forcing liquids and for obtaining pressure.

1683. C. Pottinger. Improvements in machinery or apparatus for dredging or excavating, and for driving piles.

1684. H. Cunnew. Improvements in elastic bands.

1685. P. A. A. Trouttet. A new moveable stopper for gaseous liquids.

1687. W. M. Smith. The construction of fare-boxes for the prevention of fraud on the part of drivers, conductors, &c. A communication.

1688. M. H. Chapin. Improvements in the manufacture of galloons, tapes, or ribbons for supporting steel or other hoops used for distending ladies' dresses.

1689. T. Carlill. Improvements in vent pegs.

Dated July 18, 1859.

1691. J. Bernard. Improvements in the manufacture of boots and shoes, and the means employed therein.

1692. H. C. M. Cramer. Improvements in bedsteads.

1693. J. Shaw. Improvements in the manufacture of artificial fuel.

1694. A. Phillips. Improvements in weaving carpets and in the machinery or apparatus to be used therein, parts of which machinery or apparatus are applicable to the weaving of other fabrics.

1695. W. H. Harfield. Improvements in apparatus employed in getting ships' anchors and in shackling chains.

1696. W. E. Newton. Improvements in the method of constructing and operating batteries for generating or exciting, by chemical action, electricity for telegraphic purposes. A communication.

1697. A. V. Newton. Improvements in the manufacture of india-rubber and other like fabrics. A communication.

Dated July 19, 1859.

1699. F. C. Bakewell. Improvements in extracting oils from coal and other minerals. A communication.

1700. J. Shanks. Improvements in mowing machines.

1701. H. Parent. Improvements in, or applicable to, looms for weaving.

Dated July 20, 1859.

1703. J. Erskine. Improvements in breech-loading fire-arms.

1705. W. E. Gedge. Improved apparatus for the prevention of accidents in mines, to be called a mining parachute. A communication.

1707. Earl of Caithness. Improvements in the permanent way of railways.

1709. W. E. Newton. Improvements in self-acting lithographic printing machines. A communication.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(From the London Gazette, Aug. 2, 1859.)

684. W. B. Taylor. Looms.
714. J. Bickerton. Window sashes.
726. S. Newington. Distributing seeds.
728. W. P. Wilkins. Valves.
735. S. Oram. Superheating steam.
736. W. Adamson. Propelling vessels.
738. W. Middleship. Propelling vessels.
716. F. Tillett. Cutting splints.
718. W. E. Wiley. Cases for needles, &c.
759. F. E. Sharp. Corking bottles.
762. W. Redgrave. Travelling cap.
763. E. Steane. Preventing candles dropping.
772. C. J. Richardson. Chimneys and flues.
774. J. Buckingham. Drawing fibres.
785. R. Searle. Telegraphs.
786. I. Spight. Horse hoes.
787. T. Taylor. Paper.
788. H. P. Burt. Preparing timber.
795. T. D. Shipman. Stamping. Partly a communication.
798. C. P. Coles. Defending guns and gunners.
805. T. Ivory. Rotary engines.
806. T. Ivory. Boilers and furnaces.
807. A. Morton. Sextants or quadrants.
813. D. K. Clark. Heating apparatus.
814. F. P. A. Aubertin. Food for animals.
824. A. Ripley and J. Roberts. Scraping leather.
861. J. A. H. Ballande. Paper and ink.
883. W. Henderson. Treating ores.
942. W. Sinnock. Telegraph cables.
956. W. Clark. Separating metals from their ores. A communication.
1099. W. Gossage. Alkaline silicates.
1101. W. Gossage. Caustic soda.
1329. W. Gossage. Iron and steel.
1512. G. C. Grimes. Cigar lights.
1527. W. E. Newton. Exhibiting stereoscopic pictures. A communication.
1592. A. V. Newton. Separating metals from their ores. A communication.
1597. W. E. Newton. Moving metals. A communication.
1640. W. MacKean. Starch and food.
1647. W. E. Newton. Magneto-electric machines. A communication.
1687. W. M. Smith. Fare-boxes. A communication.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 29, 1859.

283. S. B. Eveleigh.
284. R. Needham.
290. G. A. Waller.
296. E. E. Allen.
304. J. Hirst, jun. and J. Hollingworth.
305. G. Leach.
357. A. Clark.
427. R. Cookson and C. W. Homer.
489. A. W. Smethurst.
745. P. P. Boll and H. Reger.
1317. B. Samuelson.

Sealed August 2, 1859.

309. W. Clayton and J. Goodfellow.
311. J. Petrie, jun., and T. Wrigley.
317. A. Allan.
320. R. A. Brooman.
322. G. H. Baylis and F. Robinson.
323. F. H. Maberly.
332. N. Greenhalgh, W. Shaw, & J. Mallison, jun.
335. T. and B. C. Sykes.
347. J. Wilson.
393. G. Hadwen and J. Wadsworth.
398. S. H. Huntly.
418. R. Mushet.
443. H. Y. D. Scott.
445. P. E. Fraissinet.
449. J. H. Johnson.
458. P. A. J. Dujardin.
596. P. E. Aimont.
1143. W. S. Booth.
1431. W. Brown, jun., and S. Bathgate.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1809. W. E. Newton,
1820. W. Wood and M. Smith.
1821. W. Wood and M. Smith.
1823. E. P. Chevalier.
2060. W. Moberly.
2121. J. B. Robinson.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 12, 1859.

THE GREATEST SHIP.

Having twice in one week visited the greatest ship that ever swam—having wondered at her from without and wearied over her within—having examined, once more, her structure, gone over her ponderous engines, seen their massive forms in motion, marked their wondrous ease of working—having exhausted, in short, all our powers both of inquiry and admiration upon this last and greatest wonder of the world, we really feel it difficult to address our readers worthily upon so great a subject.

Our first business, however, appears to be to point out with as much exactness as is possible to whom the merit of constructing this marvellous ship is due. This is unquestionably of prime importance, because, as Lord Stanley said on Monday, if the Great Eastern succeeds, she will be a greater step—indeed, apart from the contingencies of future experience, she *is* already a greater step—in the art of shipbuilding than has ever before been accomplished in one generation "from the "day when man first began to traverse the "sea." It is impossible to look upon this ship, and to think of the promise which in a mercantile sense she holds out to us—of the enormous power of military transport with which she furnishes us—and of the services which even as a ship of war she is capable of rendering us—it is impossible, we say, to think, however imperfectly, of these things, and not at the same time to see that we probably owe far more to the man or men by whom she has been produced than to the greatest soldier, or seaman, or statesman alive. A man cannot open his eyes and look abroad over the modern world without seeing that the truly great men, the veritable heroes of this age, are they who clearly conceive and laboriously execute undertakings of this kind. In old times, when as a nation we had to fight incessantly for mere life, it was right enough to value our best fighting men above all others—to adorn them with titles and coronets—and to cluster them about the throne of our monarch. But fighting men are our greatest men no longer. The great shipbuilder, the great engineer, the great merchant, these are the foremost leaders of this time, although we have not yet begun to call them dukes and earls, and to lift them to the fellowship of our sovereigns. To say the least, such men are inferior to no others. It is well worth while, then, to inquire to whom we owe the Great Eastern.

Fortunately for ourselves and for the future historian, the authorship, so to speak, of this vessel is pretty accurately defined. In so far as the mechanical design and construction of her are concerned—and these are all with which we have to do—Mr. Brunel and Mr. Scott Russell are the only two gentlemen who make any claim to the merit of it. Nor is it difficult to define with great accuracy how much of the merit is due to each of these gentlemen respectively. The statement made by Mr. Russell in his speech on board the ship on Monday last was conceived in so fair a spirit, and agrees so exactly with statements which Mr. Brunel has on former occasions made or sanctioned, that we cannot do better than repeat it here. It was part of his (Mr. Russell's) understanding with Mr. Brunel, he tells us, that the original conception of a large steam-ship to carry her own coal upon the longest voyage, so as to avoid all the waste of time and expense which was then standing in the way of the prosperity of steam navigation for long distances, was absolutely and entirely Mr. Brunel's, and not his in the smallest degree. It was true that very soon after the thought struck Mr. Brunel, he came to him and said, "Now, I am not a shipbuilder, "and I am not an engine-builder, and I come to "you to see if you will devote your mind and "attention to the carrying out of this problem "to a successful issue. You and I will go "together through the whole undertaking, *pari* "*passu*, you shall design the ship according to "your own lines, make the engines upon your "own plan, and construct the ship according to "the best of your experience and knowledge, "but we shall always agree in this—that I am "the father of the undertaking, and that I had "the original conception." To this Mr. Russell agreed, and to this he on Monday last gracefully and warmly bore testimony, "for nothing "had," he said, "tended more to his unhappi-"ness than upon many occasions to have re-"ceived compliments for the invention, or ori-"ginal idea, when he could assure the company "he was totally innocent of it."

The merit of another great suggestion which has also been acted upon in the construction of the Great Eastern is due to Mr. Brunel. This is the application of the tubular or cellular system of construction—before applied by Mr. Stephenson in railway bridges—to the hull of the ship. On this point, however, we must be very explicit. Mr. Brunel did not practically adapt this system to the new purpose; that is to say, the arrangement of the various parts of the ship's structure was not made by him. Nor does Mr. Russell fail to state as much. In the speech before referred to he says: "My respon-"sibility was the construction, as a naval ar-"chitect, of the lines of the ship. If the ship "is slow, if she has bad qualities, the responsi-"bility is mine alone; if in regard to her "structure she is ill-made, ill-planned—if her "materials are ill-disposed or ill put together—"that is my fault; and if her engines do not, "her paddle-wheel engine especially, work well "—if her boilers are not equal to their work—"then I am almost entirely the only man to "blame. Messrs. Bolton and Watt are here to "speak for themselves, and will take the re-"sponsibility of their own engines."

Thus, with this wonderful ship in all its great features and complex details before us, we have to separate from her first the original conception of *such a ship*, and next the conception of a tubular or cellular mode of construction, and then all the rest is Mr. Russell's. That is to say, the ship itself, as a vast and novel mechanical structure, is his alone. The merit of the naval architect who designed her, the merit of the shipbuilder who built her, the merit of the engineer who placed her engines in her—all this merit is, strange to say, concentrated in one man. The abstract conception of her is Mr. Brunel's; the actual embodiment of that conception in the noble vessel which is so soon to see blue water is solely Mr. Scott Russell's. Surely no man could wish to have a prouder thing said of him!

Mr. Russell has frankly told us the secrets of his success in this unparalleled undertaking. With respect to the manner in which he had endeavoured to carry out his work, he had made, he said, a resolution which he was happy to say he had maintained—that he would not permit, so far as he was concerned, any new scheme, invention, or crotchet of his own to enter into the construction of the ship; and also, if possible, that no new, clever, or ingenious but untried invention of his friends should have anything whatever to do with it. He therefore confessed at once that there was no novelty in the construction of the ship. In building her he had thought it the best and safest course to make the lines the exact shape of those of his previous vessels which had proved most successful—to make the mechanical structure an exact copy, so far as circumstances would allow, of those vessels which he had constructed, and which had been successful; and also to make the engines exact copies of those engines which he had built for similar purposes, but not upon the same scale. "There is not, "therefore, so far as I am concerned, a single "untried experiment in the whole of the struc-"ture which the company see before them.' There is sound wisdom displayed here. Mr Russell is neither slow to invent himself, nor opposed to invention in others. But he has had the good sense to run no needless risks in carrying out the great work committed to him, and even to avoid the very appearance of what, though sure enough to his own judgment, might seem tentative or speculative to others.

Those who recollect what the condition of the Great Eastern was when launched, and who have this week seen her as she now is, will not fail to recognise in her rapid and efficient completion another ground for connecting the name of Mr. Scott Russell in the closest possible manner with the history of this great ship. It has been our good fortune to have opportunities of observing the progress of the works on board of her during the last nine weeks, and we hold it impossible to over-estimate the fertility of resource, the promptness of action, and the skilful disposition of men and material which have been displayed by the one directing and controlling mind. Knowing something of the manner in which our public departments are at present handled, and seeing what a single man has accomplished in this private enterprise, we do not wonder that men sometimes grow weary of the delays, the extravagancies, and the failures of the former, and sigh to see the swiftness, the economy, and the success of the latter imparted to it.

Now the Great Eastern is all but finished, it becomes our duty to fix our mind once more upon the true object with which she has been constructed. Trips to America and back can afford no kind of test whatever of the commercial success of this ship. Only continuous voyages of several weeks' duration—to India, China, or Australia, and back, for example—can give her a fair chance of proving her value. As she is to go down the river on the 21st or 23rd instant, and will make her trial trip early in September, it should be understood, as Mr. Russell said on Monday, that she never was intended for short voyages; and though she would be tested *on* a short voyage, she was not to be finally tried *by* such a trip. What the great ship must be tried by is that for which she was originally intended, viz., a voyage to Australia or India in thirty-three or thirty-six days. "It "is most important," said he, "to bear this in "mind, because if our distant colonies can find "themselves brought by the ship within thirty-"three or thirty-six days of the mother country, "they will not remain long satisfied without "having a fleet of such ships, and without "making such commercial arrangements as will "admit of their being established to make re-"gular voyages."

There is another consideration connected with this unexampled vessel which must not be forgotten. Without in the least degree detracting from her commercial qualities, or increasing her cost, Mr. Scott Russell has so constructed her that no less than three hundred and sixty 10-ins. guns might be placed on board of her and fought, if the Government should at any time desire to convert her into a ship of war, either temporarily

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or otherwise. This is no small matter. She is already, it should be understood, proof to ordinary round shells, and her speed will at least be fifteen knots an hour in all probability. Moreover, her bow is both fine and strong enough to secure her against material injury should she encounter a foe after the fashion of a "ram." She is likewise divided into numerous watertight compartments. We need take no pains to express what the value of such a ship, armed as we have said, would be to us, as a weapon of either offence or defence.

In many other ways this, the greatest of ships, is suggestive to us. She is, we believe, the beginning of a new era in ocean navigation, and this, if we mistake not, not as a mercantile agency only. But further consideration of this subject must be deferred. We must not, however, omit to notice the few sensible comments offered by Mr. Russell on the launching of the Great Eastern. There had been a great difficulty with respect to the launching of this vessel, he said. But the mode of launching had nothing whatever to do with the principles on which the ship was constructed. It was entirely an afterthought. The plan tried was one which, he considered, ought never to have been adopted. It would never, he hoped, be resorted to again for the launching of any ship. "The "Great Eastern might have been launched with "a great quantity of grease and oil upon smooth "oak planking—a mode which succeeded every "day in practice, and with respect to which "there was no difficulty whatever. In future, "therefore, whenever any large ship like this "was to be constructed it would not be at all "necessary to invent any new method of launch-"ing, but simply to adhere to the good old plan "of the shipbuilders, of oak planking and plenty "of oil and grease." This is precisely what we said at the time, and we only quote Mr. Russell's words for the sake of showing that the scheme adopted by Mr. Brunel was no shipbuilder's device, but purely his own.

THE DOCKYARD COMMITTEE OF ECONOMY.

ONE may write on great public topics for a year and never have his statements questioned, provided his facts be false and his inferences erroneous. But only let his information be sound and his conclusions certain, and he will inevitably be speedily and flatly contradicted to his face. Let no reader of ours suppose, therefore, that we expected our last week's article on the Dockyard Committee of Economy to pass unchallenged. Had we taken any other than a plain and simple course—had we turned our back upon facts and started into the region of fancy—had we shut our eyes and dreamed instead of keeping them steadily open and using them—then we might have written ourselves gray, and never elicited a sign, either of praise or dispraise. The great sin in all such cases is to know where the vulnerable point is to be found, and to aim at that. Strike there, and the wounded creature—even although it be an Admiralty Committee—must writhe and rage.

Now, had the Committee in question been properly constituted, it would have been invulnerable at all points. Had it been designed and framed for the honest purpose of ascertaining and correcting such defects as might have been found to exist in our dockyard establishments, and had that purpose been purely and faithfully carried out, any attempt to discredit its decisions—whether made by us or by others—must have brought only shame and confusion upon its authors. But it was not so. This Committee, as is well known, was not appointed in simple good faith. Mean aims and considerations were mixed up with it from beginning to end. It was therefore both a bad and a vulnerable object, and it became our duty to assault it. This we did with earnestness, but at the same time with perfect fairness. We did not, of course, attempt to bludgeon the vitality out of it with mere angry speech. We intended that our blow should be fatal, if possible, and aimed it accordingly at a vital part. That vital part was, we admit, in a curious place. Like Paris, we had to drive our arrows at the heel rather than at the head or the breast of our Achilles. But, if our object was a just one, our means of attaining it cannot, we think, be questioned.

On another page we print a protest against our last week's article, from the pen of Mr. Murray. The only portion of this protest which greatly concerns the public is that in which he disclaims the "prominence" which he considers we have given to his "name." This is not exactly what Mr. Murray means, we presume, because his "name" had not, so far as we are aware, any considerable prominence given to it. What is doubtless meant is not the prominence given to his name, but the preponderance attributed to his influence. The context implies that this was intended, because we are told that we "have formed a very false estimate "of the part taken by the other members of the "Committee." In support of this view of the matter Mr. Murray does not give us the slightest assurance of the activity of these gentlemen in shaping the evidence received by the Committee, or in penning its Report. He contents himself with pointing out the antecedents of Admiral Smart and Mr. Laws, and referring vaguely to Mr. Bowman's experience. Admiral Smart, he reminds us, was Superintendent of Pembroke yard—a yard from which the great "repairing" branch of the shipbuilder's craft is almost wholly excluded, by the bye, and to which we believe *the Committee never went*—and Mr. Laws has been a clerk, a secretary, and a store-receiver. It may suit Mr. Murray's purpose to pretend that these circumstances are sufficient to fit the gentlemen in question to sit in judgment upon the whole art and mystery of the naval architect and shipbuilder, the engineer, the blacksmith, the joiner, &c. But we address a class of readers who know much better.

Let us consider, for example, the subject to which Mr. Murray himself alludes in his letter—that of the training of naval architects—and let us inquire what qualifications these gentlemen have for pronouncing, we will not say a decision, but an opinion even upon this question. By all who have the slightest claim to be consulted upon such a topic, it is held essential that the superior shipwright officers of a dockyard should be well skilled in the science as well as the art of ship-construction. But this science cannot be at all thoroughly studied without a preliminary mastery of many of the higher branches of mathematics. We have lately seen in our own columns that the rules by which the most elementary calculations of the naval architect are made cannot be conveniently investigated without recourse both to the differential and to the integral calculus. Every mathematician knows that many subjects must be gone through before even these are reached, and every educated naval architect is aware that these are by no means the limit of that which he has had to master. The difficulty is, then, to provide generation after generation of men trained in all the science of the naval architect, and fit also in other respects to become mechanical officers of the highest class, while, at the same time, they shall have had sufficient practical acquaintance with the work of the dockyard to enable them to conduct that work efficiently. This was one of the most vital questions that called for the decision of the Admiralty, and this, we fearlessly assert, neither Admiral Smart, Mr. Laws, nor Mr. Bowman was in any sense competent to form a judgment upon.

Three methods of accomplishing the object have been proposed, and two of them tried. The first consisted in introducing a class of apprentices from a grade of society superior to that from which dockyard apprentices are ordinarily derived, and in affording them an exclusive training under masters and professors specially appointed for the purpose. The whole of the present master shipwrights of the dockyards (with a single exception) were trained in this manner. This first plan was incontinently put an end to by Sir James Graham many years since. The next method consisted in selecting by competitive examinations from the ordinary apprentices of the dockyard (all of whom, be it remembered, have been under the instruction of good schoolmasters for many years past) a very limited number of the most promising, and in sending these to Portsmouth to be trained by special masters and professors in all that pertains to the shipbuilder's profession. This plan was put in operation about eleven or twelve years since, and continued in existence only four or five years. The third plan is that which the Committee before us has proposed, and this consists in entering the sons of gentlemen in the dockyards, to be trained expressly for master shipwrights and assistant master shipwrights, all promotion to these offices being for the future almost exclusively reserved for these young gentlemen. Now, we have no space here to discuss the relative merits of these three systems with any minuteness; suffice it for us to state one great principle which we would lay down for our guidance in this matter. It is this: Seeing that no known or conceivable system of training youths can by possibility make *all* who are trained fit for responsible office, or can be expected to do more than turn out a small per centage of eminently able men, we ought to adopt a plan which will enable us to leave a majority of our trained men, if need be, in inferior positions without doing them injustice. In other words, we ought to adopt a system which, while it will furnish us with a goodly number of efficient officers in high positions, will saddle us with no bad ones. Any man of sense will see in a moment that the Committee's system will not bear this test. For every thoroughly good officer it would in all probability give us at least three bad ones, and thus largely help to ruin the service which it is vainly designed to aid. We may say much more on this important subject, but we cannot say it now.

We have thus far dealt with Mr. Murray's letter in its general aspect. There remain, however, a few words of another kind to be said. We have inserted that letter, not because the writer has any just claim upon us for the publication of a single line of it—for he in no way helps the public to form an altered judgment upon the merits of the Committee—we have given it a place simply because we see no reason whatever for refusing to comply with Mr. Murray's request that it might be inserted. What Mr. Murray's object is in the last half of it we cannot divine. One thing, however, we hasten to say respecting it, and that is, that he need not speak so bitterly as he does about our insinuations against his "cha-"racter." Mr. Murray's character is not a legitimate object for our criticism, and we have not, we think, ventured to criticise it. If Mr. Murray will take the pains to calmly re-peruse what we said, he will find

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that it amounts only to this, viz., that he appears to have, perhaps, a somewhat overweening consciousness of ability; that he was thought by some to have been too pliant to the desires of Mr. Corry; that he has no claim to be esteemed as a naval architect by the public; that as an engineer even he has not distinguished himself in any remarkable manner; and that he is guilty, perhaps, of a peccadillo or two in regard to the re-distribution of official responsibility in our dockyards. Now, to call statements like these a "personal attack," when they are simply directed against a member of a Committee, or to call them insinuations against a man's "character" when they are merely adduced as reasons for thinking lightly of an official report, is, we submit, to wrest language from its daily uses. Against Mr. Murray, as Chief Engineer of Portsmouth Dockyard, we have not a word here to say, much less have we a syllable to breathe against his character. All that we contend for, and all that we say is, that the Report in question is mainly Mr. Murray's, and that we have good reason for refusing to accept Mr. Murray's manifesto as a basis for great and sweeping changes in our dockyard establishments. We distinctly assert that we have made no attempt whatever to filch from Mr. Murray or from his colleagues "such good names as they have." All we ask is, that if he or they have any special claims to public esteem or homage, they will tell us so. We will gladly make them known.

There is one thing which, for Mr. Murray's own sake, we most sincerely hope: it is that his remarks about one of ourselves were not put forward with any paltry or vain desire to detract from the influence of our present labours by a reference to our mode of starting life. This part of Mr. Murray's letter is written in such peculiar English that we cannot discern exactly what he means. His statement amounts apparently to this—that he does not consider it necessary to reply to what we said last week, because we studied naval architecture under a system of which he disapproves! That appears to us a curious kind of announcement, and we doubt not it will appear so to others. On a question of this kind we shall, we trust, be pardoned for a remark that may appear somewhat egotistical; and we venture to say that the training which Mr. Murray seems disposed to put a slight upon, is precisely that which the *Times* lately put forward in repeated leading articles, as the ground upon which it based its confidence in our statements, and claimed for them the highest authority.

If Mr. Murray can really be so mistaken as to suppose that we are in the least degree sensitive as to our origin, we can only invite him to change his mind. We do not scorn his supposition; we merely smile at it. In this day, when nine out of ten of our eminent engineers and shipbuilders, to say nothing of other classes, began life in some form of apprenticeship, it is too late for any one to attempt to produce even a blush on such a subject, especially when intellectual competitions have, from the first, been the only steps by which a man has ascended. We do not ask where Mr. Murray sprang from, because we do not feel an atom of interest in the question, and because if we did we should have no right to make the inquiry. On the contrary, we would urge him to lose sight of such frivolous questions altogether. A man is now estimated, not by the station of his father, but by his own endowments; and Mr. Murray is perfectly welcome to the support of the few who think otherwise.

If Mr. Murray be fair and friendly he is free either to write to us in a suitable spirit or to remain silent. If he be hostile, and must fight, let him not babble of our boyhoods, but take for his weapon what a Hyde-park orator lately called "the bright and cutting intellect." If he can then show us that his weapon is well-tempered, and wielded nervously, we will not ask him on whose milk he was suckled, or where his sword was forged.—E. J. R.

THE NEW MIXED METAL COINAGE.

It will have been observed by the public that the Chancellor of the Exchequer asked the House of Commons on the 4th instant for £10,000 only on account of the new coinage of bronze, instead of £50,000, which was the sum originally set down in the estimates. This wide departure from the original intention of the Government is puzzling, and we regret to say that the subsequent remarks of the right. hon. gentleman afford no satisfactory explanation of the change. Mr. Gladstone is reported—and no doubt accurately reported—to have said that, "when the operation of coining money of mixed "metal was first contemplated, it was supposed "that in order to carry it on with sufficient "rapidity Government would have to purchase "presses and supply them to the contractors; "but on inquiry it was found unnecessary to do "this." Hence, by inference, the reduction of the sum asked for. Now, there is something so completely contrary to the practice of the Government in the purchasing of machinery for Government contractors, and, it must be added, contrary also to common sense, that we are quite at a loss to know who could have "supposed" such a course necessary in the first instance, or how a gentleman of Mr. Gladstone's sagacity could with gravity mention it in the House of Commons. Evidently there is another reason than this for the alteration, and in time possibly it may ooze out.

If the Government thought seriously about buying new coining presses, they would be most likely to erect them on their own premises, and not on those of other people: and certainly the cost of such machinery would soon be covered by the profits of the bronze coinage. Coining presses of the most modern and improved make cost about £200 each, and the Royal Mint itself contains only eight of these money makers. Forty thousand pounds—which is the extent of the reduction in the estimate—represents therefore the purchase-money of *two hundred* coining presses. Would Mr. Gladstone in seriousness invite us to believe that when the sum of £50,000 was jotted down in the Civil Service estimates, class 7, for the new coinage, he thought two hundred presses would have to be paid for out of it and supplied to the contractors? Surely not, unless he deems his audience much more credulous than it is. Why, two hundred coining presses, working at their minimum rate, would stamp into existence 12,000 coins of bronze, or any other mixed metal, per minute; 720,000 per hour; 7,200,000 per day; or between forty and fifty millions per week! But really, with all deference to the Chancellor of the Exchequer, we must say there is something preposterous in the whole story. Contractors would rather buy coining presses than receive them from the Government, and the Government would rest content with a fair price for the contractor's coinage rather than be "bothered" with finding machinery and complicating the bargain. There is a class of Her Majesty's servants whose duties lie partly afloat and partly on shore: to these the tale of the coining presses may be told.

The Minister's statement with regard to the deplorable condition of the existing copper coinage, however, was, as every person is aware, perfectly true; and the necessity for supplanting it was very forcibly demonstrated. It is not necessary to recapitulate Mr. Gladstone's evidence on this point, for our columns have been the vehicle for conveying to the public a knowledge of all the disadvantages attending the present coinage, and earnest appeals to the Ministry for their correction. Reference, indeed, to a file of the Mechanics' Magazine for the past six or eight months might have saved the Chancellor of the Exchequer from some statistical errors into which he inadvertently and therefore pardonably fell. Instead, for example, of there being in circulation—as the daily press makes Mr. Gladstone assert—only £800,000 worth of the deteriorated and unsavoury coins of copper, weighing 3,500 tons, there is about £1,250,000 worth, weighing 6,000 tons. Again, the right hon. gentleman would certainly not have told the House of Commons, had he consulted our pages, that the 1 lb. of copper is coined at present into 26 pence, and proportionate numbers of halfpence and farthings, when, in fact, no copper monies coined in these realms have been so proportioned since 1823, when the Irish coinage of such pieces ceased. Twenty-four pence, forty-eight halfpence, and ninety-six farthings have been the rates of pieces to the lb. avoirdupois from that year to this day. Apart from these trifling errors, and the very grave one of reducing the vote to a point which makes it almost valueless in promoting the first movement towards a great reformation, there is not much to object to in the ministerial statement. The principles for which we have contended are agreed to by the Government; but about the means of reducing those principles to practice in a speedy and successful manner we as yet differ. We, for example, do not approve of putting any portion of the new coinage into the hands of contractors at all. At Calcutta, at Bombay, and at Madras, they are increasing the resources of the respective mints so as to render them equal to the demands likely to be made upon them. Why not do the same with the Royal Mint of London? Eight coining presses were erected therein in 1810, and eight are all that that establishment boasts in 1859, although the quantity of work required of them is fourfold greater now than then. At Calcutta they will presently possess twenty-four, at Bombay sixteen, and at Madras eight presses. Why not, with the new coinage before it, give the English Mint double its present number—sixteen? Ten thousand pounds' worth of mixed metal coins would, in such case, without the co-operation of Birmingham, soon pass into circulation, and the profits of the coinage would pay for the presses. With respect to the mixture of metal chosen for the new money, it may be said that in all respects it is a good selection. Copper, 95 parts; tin, 4; and zinc, 1, form together a hard, clean, agreeable-looking, and not bad smelling composition, and will show off the engraving and devices of the coins to great advantage. Of the sizes of the various denominations of coin something may be said, for it is a question of importance.

As we last week gave the exact and individual weight of the copper coins circulating throughout the British dominions, so it may be as well to give as a guide now their individual diameters. The British penny of the coinage of Victoria is decimally 1·335 inches in diameter; the halfpenny, 1·108; the farthing (identical in size with the sovereign), ·863; the half-farthing, ·688; the one-third farthing, ·590; the quarter farthing, ·515; and the oboli, ·625. Now, in all probability the circulation of the colonial small coins will remain as heretofore; but since it is determined to lessen the weight of the three superior denominations, it would be right to reduce their diameters as well as their thickness, maintaining a proper proportion between

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them. If the bronze penny was to be made of a diameter say 1·200 inches, the halfpenny 1·00, and the farthing ·800, there would be given, as we imagine, quite enough of superficies in each to afford ample room for the design of the engraver; and, supposing the 1 lb. weight of metal to be coined, as we think it will be, respectively into 48, 96, and 192 pence, halfpence, and farthings, there will be enough thickness to "get up" a bold impression upon them.

These pieces would be valuable, too, as measures, for 10 pence would, if placed flatly in line and in contact equal one foot; 12 halfpence would also equal one foot; and so would 14 farthings. This would be at once a simple and useful arrangement, and we offer the suggestion of it humbly to the Government. The profit of such a coinage as this would certainly be great, for whilst the market prices of the metals composing the bronze mixture would make it little more expensive than copper alone, it would be nominally of double the value of copper when coined. Thus, though a ton of the existing copper coin represents a value of £224, a ton of the new bronze coin would represent £448—a tolerably wide margin of gain for Her Majesty's minters.

THE MAIN DRAINAGE SCHEME.

Most of our readers will remember that, shortly after the "great bell" at St. Stephen's began first to vibrate through the heavy atmosphere of London, an honourable member considered that the proper time had arrived to make certain uncomplimentary remarks upon its lugubrious tones, and to propose that since it could not be made to sound more like an ordinary bell, it should be put a stop to altogether, and allowed to remain as a monument of miss-spent money, labour, and engineering skill. It is with some degree of apprehension that we look forward to a similar objection in the case of another great public undertaking, when it shall have been duly completed. Then, of course, we, in common with Members of Parliament and others, shall be better able to judge of its value and of the wisdom that prompted it; although, it is true, our judgment may be of little avail, and of that description which bears no relationship either to foresight or inductive observation.

A detailed account of the scheme of metropolitan main-drainage was lately given to the public in the columns of the *Builder*. It is not our intention at the present moment to enter into a résumé of the same; nor even to pay tribute to the vastness of the enterprise or the ingenuity of the elaborate contrivances at the pumping station, overflow chambers, storm outfalls and penstocks. Our admiration for each detail and for the magnitude of the general undertaking is lost in our bewilderment that such gigantic and perfect appliances should be employed to such an end as that proposed by the Main Drainage Committee and the Metropolitan Board, and tacitly sanctioned by the representatives of the nation at large, who delegated to these bodies their responsibility in the matter. With regard to this responsibility we are aware that Mr. Thwaites and his coadjutors are in the category of those great men who are answerable only to themselves and to posterity; and we accordingly look upon them with the same degree of awe and respect that would be inspired by any other impersonation of the power of good and of evil. Whether any incense save that arising from their own works will reward their herculean labours, they will at least possess the fame which men award equally to those who have done much for the advantage of their species or for the contrary. If they fail, it will be in effecting great things. Their immortality will not be to live for ever in the vicinity of Greenwich, nor to feel the dearth which their splendid contempt of the speculations of theorists, respecting the annual loss of so many tons of phosphates, may produce throughout the land. Let civilization supply these phosphates from distant rocks, if they *must* exist wherever the waving wheat and barley is to spring from the soil; or let our cereals come from other lands—from France, for instance; their work is in the present, *après eux le déluge!*

In France they are managing these things better, certainly in regard to the future and its inevitable necessities—perhaps also with respect to the present; since no putrefying organic compound, no choleic acid from the human bile will now be allowed to evolve its sulphur in deadly miasma from the waters of the Seine. The intercepting sewers on either side of this river are already finished, and their contents, properly deodorised, and retaining all their valuable constituents for their due purposes in the economy of nature, are to contribute to the fertility of the surrounding land. Public opinion, when founded on the dictum of men of science—whose researches, based upon close investigation, accurate experiment, and exact deduction, have given to the world those facts upon which will depend the prosperity of nations—appears to be held in greater respect under the "enlightened despotism" of France than it is by the Boards and Commissions of our own free country. It is not from any want of general enlightenment that such plans as the Main Sewage Scheme are allowed to pass current in England. A Member of Parliament may inform us, in presence of the testimony to the contrary of Dr. Hoffman and Mr. Witt and of Dr. Letheby, that in his opinion the lime thrown into the Thames "has already been productive of a beneficial effect;" but apart from the evidence of one important organ of sense, everybody who has made any inquiry upon the subject knows that this is not the case, and that about 65 *per cent.* of organic matter is only removed by this means for a limited number of days or hours from its original sphere of decomposition. Our representatives, engrossed with many other important matters, may for an instant be arrested by the wonderful plan of a foreigner for concreting the bottom of the river; but the generality of the "intelligent classes" can better appreciate the difference, with respect to the practicability of this method, between the Thames and the lake in St. James's Park, and are more inclined to bestow their attention upon the more feasible arrangements proposed by Mr. F. O. Ward or Mr. George Coode.

Never yet, perhaps, was a public enterprise of a similar character begun and continued—we will not say ended—amid such universal reprobation as that which has attended the main drainage scheme. Every print within whose scope it falls has in turn raised its voice against the plan. Reprobation is far too mild a term to express the feeling with which men of science as well as the general public regard the gigantic blunder by which, at the enormous expenditure of money, and a sacrifice of time which in this instance is not money but life, the concentrated sewage of London is to be discharged at Barking Creek and Crossness Point. Execration would, perhaps, be a more appropriate word for that which met the birth and which follows the progress of this scheme in the minds of men who can realize the full enormity of the outrage against sanitary science, the well-understood laws of national agricultural economy, and common sense, which is comprehended in this measure.

THE REAPING MACHINE.

We have this season witnessed several successful operations with the reaping machine, and have to congratulate Messrs. Burgess and Key upon the important results thus obtained. We cannot, however, altogether acquit the farmers in some districts from a yet lurking shadow of prejudice against this mode of rapidly getting in their harvests. In many districts visited by us, the scarcity of labour was such that 25s. and even 30s. were being cheerfully paid for labour, and in others labour was not to be obtained at any price beyond that afforded by neighbours, the militia, and schools. Yet is this machine scarcely known in such parts; and where best known, we regret to add, fairplay is not altogether accorded to it. A field of wheat, of barley, or of oats, standing proudly before it, falls with a rapidity perfectly marvellous; and the bye-standers are not slow to testify their wonder and admiration. But let a portion of the crop be laid low by wind or storm, with the grain *from* the machine, and the machine must necessarily, from its very construction, pass over it. Here, then, is food for derision and prejudice. But is this justice? There is not a man amongst the spectators who, when on the best of bone and blood, would put a horse to an impossible fence. Yet even this, which is apparently impossible with the machine, can be rendered facile if fairplay is accorded to it; for we have but to leave those portions of the crop thus circumstanced until the last, and then meet the difficulty in a rational way, and remove it. Indeed, there is not a portion of a crop that may not be cut if tact is exercised, and this tact will assuredly be acceded as the want of labour is more and more felt. The corn alone that has fallen out of ear this season, and which might have been saved had the machine been *in reach*, would have paid for its use in perpetuity upon many a farm.

We hear that the Royal Highland and Agricultural Society have awarded the first prize to Burgess and Key's machine. This is remarkable, inasmuch as no less than eleven Scotch, three English, and one American machine were opposed against it.

Amongst other extraordinary performances well accredited, is that effected upon a farm in Surrey, where 141 acres of wheat and twenty acres of oats were cut in eighty-eight hours by one machine at a cost of 4s. per acre. The small cost of the wear and tear of these machines is something equally worthy of notice. Alderman Mechi has used his reaping machine for eight years, and its annual cost has not exceeded an average of 2s. 6d. per year for repairs.

THE CASE OF HENRY CORT, AND HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

No. VIII.

To the "State of Facts" published in 1787, relative to the making of bar iron, by Henry Cort, is added, by way of Appendix, the following authentication of its contents:—

Extract from Lord Sheffield's "Observations on the commerce of the American States":—

"If Mr. Cort's very ingenious and meritorious improvements in the art of making and working iron, and his invention of making bar iron from pig iron, either red short or cold short, and the great improvements on the steam engines by Messrs. Watt and Bolton, of Birmingham, and Lord Dundonald's discovery of making coke for the furnace at half the present expense, should all succeed, as there is

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reason to think they will, the expense may be reduced so greatly, that British iron may be afforded as cheap as foreign, even if the latter should be allowed to enter duty free, perhaps cheaper, and of as improved a quality, and in quantity equal to the demand. It is not asserting too much to say that event would be more advantageous to Britain than thirteen Colonies. It would give the complete command of the iron trade to this country, with its vast advantages to navigation; and our knowledge in the iron trade seems hitherto to have been in its infancy."

Extract of a letter from Doctor Joseph Black, Professor of Chemistry at Edinburgh, dated May 15, 1786:—

"I meant also to have explained to you my opinion of Mr. Cort's process of making iron; it is this: I have never analyzed the iron made by that process, as I always considered direct experiments to prove its toughness in its hot and cold state, as also its strength and other good qualities, as the most interesting and decisive trials, and I like the process, and the iron, for these reasons—

"First, it does not require the expense of charcoal, but is preformed with raw pit-coal.

"Secondly, The iron is heated and wrought with flame only, instead of being mixed with the burning fuel and ashes, which is the case in the common process; and it is difficult to imagine how these extraneous matters can ever be completely disentangled from it again in the common process.

"Thirdly, Mr Cort's method of forming the bars by means of rollers is better fitted for squeezing and forcing out the melted slag from every pore of the iron, and, therefore, for giving such iron perfect solidity and close contact and cohesion of its parts more than the common method with the hammer.

"Fourthly, By the experiments made here, I saw that Mr. Cort's iron was exceedingly soft and malleable when hot, and very tough when cold; and I have heard of much more decisive experiments made in England, which prove it to be possessed of very good strength and toughness: for these I refer to Mr. Cort, who, I suppose, can give evidence of them. The only point which remains undecided with me is, whether Mr. Cort's iron can be afforded sufficiently cheap; and this point will be surely decided by any company who may establish works on his plan. I am informed that a great deal of bar iron is now made in England sufficiently cheap, by another process, in which also the expense of charcoal is avoided, but such iron is not of the best kind."

Extract of a letter from David Hartley, Esq., dated Golden Square, June 19, 1786:—

"Having heard that Mr. Cort had discovered a method of making the very best of iron out of common iron ballast, by a short and simple process, I went to his works, and, as far as I could judge, his invention appeared to me to be founded on simple principles, for reducing iron to its natural and heat state, by the expulsion of all heterogeneous and unmetallic particles; the fundamental principle being, that iron is in itself a simple homogeneous metal, and that all iron is equally good when purified from heterogeneous and unmetallic particles.

"The ordinary mode of converting cast iron into malleable iron is by the use of a very great quantity of charcoal, which contains what the chemists call *philogiston*, and which has the quality of remetallizing demetallized particles, which are mixed up with iron while in fusion. The method used by Mr. Cort is not by charcoal. He uses sea-coal entirely, because it is not his principle to remetallize any of the demetallized particles, but to expel them.

"The process, as I saw it three or four times over, is something to this effect: Between two and three cwt. of common iron ballast is melted in an air furnace with sea-coal. When melted, it spits out in blue sparks the sulphur which is mixed with it. The workman keeps constantly stirring it about, which helps to disengage the sulphureous particles, and, when thus disengaged, they burn away in blue sparks. In about an hour after melting the spitting of these blue sparks begins to abate (the workman stirring all the time), and the melted metal begins to curdle, and to lose its fusibility, just like solder when it begins to set; the cause of which I take to be this—the stirring not only disentangles the sulphur, but it gives opportunity for like to meet with like, by which means metallic particles meet and coalesce, never to separate again, and then they become unfusible. The unmetallic particles, which, being of a vitrifiable nature, contribute to flux the whole mass, are partly calcined and partly burnt away. The whole mass at the end of the first part of the process consists of metallic particles and dross sticking together, but not incorporated. The clotting of the metallic particles by the stirring about may be compared to churning. As the stirring of cream, instead of mixing and uniting the whole together, separates like particles to like, so it is with the iron; what was at first melted comes out of the furnace in clotted lumps, about as soft as welding heat, with metallic parts and dross mixed together, but not incorporated. These lumps when cold resemble great cinders of iron: they are called loops.

"The next part of the process is to heat these loops to the hottest welding heat in an air furnace, and to put them under a great forge hammer, which by a few strokes at the very highest point of the welding heat, consolidates the metallic parts into a slab of malleable iron, about three feet and a-half long and three inches square. The hammer at the same time expels and scatters the unmetallic dross. These slabs are brought to a wedge point at one end. They are malleable iron, but still with a considerable mixture of dross.

"The last part of the process is to heat these slabs to the hottest welding heat in an air furnace, and then to pass them through the rollers of a rolling mill; the slabs being extremely soft at the highest point of welding heat, the force of the rollers consolidates the metallic parts into bar iron, and the dross is squeezed out and falls under the rollers. This is the whole process; and thus in about six hours I have seen a piece of common iron ballast rolled into a ship's bolt; I have seen this bolt laid hollow across the eye of a large forge hammer and receive two hundren and fifty strokes of the heaviest sledge hammer, and thus bent double, but without breaking, or suffering the least apparent injury.

"I conceive the two principles of this invention to be, first, burning off and calcining the sulphur and the demetallized particles of ballast iron, instead of endeavouring to restore the demetallized parts with charcoal at a great expense, and still leaving the business undone; and, secondly, expelling the dross and consolidating the metal by squeezing it through the rollers, instead of the common mode of hammering, which requires a considerable length of time, during which time the metal loses the softness of a welding heat, and becomes too hard to suffer the expulsion of the unmetallic parts. The common mode, therefore, operates with much less effect than Mr. Cort's mode, because it operates upon a less degree of heat and softness. It consolidates heterogeneous particles into the body of the iron, instead of expelling them by the expeditious and forcible impression of the rollers in the softest state of welding heat. It is to be observed, likewise, that the common blooms, as they are called, in ordinary forges of iron, are nearly three times as thick and solid as the slabs in Mr. Cort's process, and therefore much less affected by the blow of a hammer than his slabs are under the effect of the rollers. His slabs are small, soft, and ductile, and therefore easily suffer the expulsion of the dross by the squeezing of the rollers.

"These appear to me to be the principles of Mr. Cort's discovery. They appear to be conformable to chemical reasoning, and to the general principles of metallurgy. The demetallized particles of ballast iron, so demetallized by the sulphur in the ore, form the alloy of iron; when the sulphur is carried off by the fire, and by stirring the metal about while in fusion, and when the alloy of unmetallic particles is expelled by the application of the hammer and rollers in the softest state of welding heat, the metallic parts thus kneaded and consolidated together form the refined and homogeneous metal iron. Mr. Cort may therefore be said to have discovered for this country an immense iron mine above ground, as all pig iron and common ballast iron may by his process be purified into good metal. It is not improbable that this discovery may produce a great revolution in iron matters between imported and home-made iron.

"The proof of facts forms the basis of the case. The illustration which flows from the discussion of principles confirms the interpretation of the facts into proof of the merit of the invention; because those facts proceed through every stage of the process coherently with the principles which constitute the invention, and consistently with the general and acknowledged principles of metallurgy, and because the perfection of the metal results from the strict adherence in the operation to the principles of the process."

Extracts from Dr. Black's "Remarks on the Experiments made to Prove the Strength of Mr. Cort's Iron, dated Nov. 2nd, 1786":—

"The bar iron made by Mr. Cort was distributed to the different dockyards, and manufactured by the King's smiths into anchors, bolts, rings, hooks, and other articles belonging to shipping which occasionally resist very violent pulls, or support great weights; and similar articles were at the same time made of the best Swedish iron, as exactly alike to the former in weight, size, and form as possible. The experiments to compare the strength of the two kinds of iron were afterwards made by opposing an article made of the one to the similar article made of the other; and from the description of the experiments it is plain that they have been made in the most fair and decisive manner. The two kinds of iron were tried in each experiment with the same force or strain gradually increased until one of them gave way, which, however, did not happen in general until after the strain was increased to a far greater degree than any to which the same articles are exposed in actual service.

"When we sum up the results of these experiments, it is evident that Mr. Cort's iron is superior in strength to the very best Swedish iron; for such alone was employed on this occasion.

"There were six comparative trials of anchors; Mr. Cort's iron was found stronger than the Swedish in five of these trials.

"The comparative trials of hooks and iron-bound blocks were twenty-eight in number. Mr. Cort's iron proved stronger than the Swedish in ten of these trials; equal in fifteen; weaker in three only.

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"And even of these three two were not quite equal, viz., the trial at Woolwich of second-sized hooks, and second trial of top-tackle iron-strapped blocks at Chatham.

"The comparative trials of bolts in driving and in holding fast were fourteen. Mr. Cort's iron proved the stronger in three; equal in seven; weaker in four.

"But in one of these four experiments, viz., that with the P bolt at Plymouth, 5th of August, there was a defect in the workmanship of the bolt made with Mr. Cort's iron. And it must be remembered, that in all these trials the strain applied to the different articles was far more violent than any to which they are exposed in actual service except the driving of bolts; and in this operation Mr. Cort's iron had the superiority. The general result of these trials, therefore, gives full conviction of the excellence of Mr. Cort's iron."

Another important class of testimony to the success of the invention is afforded by the agreements entered into with, and the conduct of those engaged in the same manufacture, who must be presumed to have been alive to the importance of the subject, and be competent to form a judgment thereon.

Among the persons competent to form such an opinion, William Hawks, of Gateshead, would be prominent. By agreement, dated the 29th of May, 1784, between Cort and Hawks, after reciting the grant of a patent 13th of February, 1784, the second patent, and that Cort had informed Hawks that part of his invention consists in the making of pig or other cast metal whether of a cold, short, or other quality into tough merchant iron without either coke, coal, or charcoal, and without blast of bellows or cylinders, which was never before known or practised in Great Britain; and that the said Hawks was desirous that the said Cort should make known to him the said invention;—it was agreed, for the consideration stated, that Hawks should have the privilege of making pig or other cast metal, whether of cold, short, or other quality, into tough merchant iron, without either coke, coal, or charcoal, and without blast of bellows or cylinders, paying 20s. for every ton of malleable iron shingled into half-blooms, slabs, or other forms proper for making into tough or merchant iron, each ton to be accounted to weigh 2240 lbs. weight. The agreement contains clauses for accounts, &c., and against his making known to any person the manner of practising the invention, for determining the agreement, and for a penalty; and a memorandum annexed, that instead of the 20s. per ton specified therein, one-third of the sum saved should be paid by Hawks to Cort for every ton of iron manufactured into bars or uses of merchant iron. Other similar agreements, reserving royalties of variable amount, and conditions under special circumstances, were entered into with Messrs. Brodie, Crawshay, Cooke, and most of the principal iron masters, which, but for the unfortunate sequel, would have yielded a princely return to the meritorious inventor and those associated with him in introducing the invention.

It may be presumed that Cort shared the fate of most, if not all other inventors in having the validity of his patent questioned so soon as the success of the invention was established; and the following opinion of Mr. Justice Chambre, when at the bar, will be perused with interest.

"To establish a right to the monopoly of an invention under letters patent two things are necessary. 1st. That the invention is new, and not laid open to the public at the time of obtaining the patent. 2ndly. That the invention be sufficiently explained in the specification so as that persons of competent skill in the arts, as practised before the improvement, may be thereby sufficiently instructed in the principles of the new invention, and enabled to put it in practice.

"The application of these rules of law would be better made by an artist than a lawyer, as his knowledge of the art would better inform him how the matter of fact is established by evidence: and the questions will be merely matters of fact, for the law is clear. As far as I can judge, the specification is unexceptionable. I think, too, under all the circumstances, that Mr. Cort appears to be the first person who perfected the discovery, and consequently that his patent is valid. However, this is a point upon which no very decisive opinion can be formed without knowing what can be offered in proof of the discovery being of older date. The idea of applying an air furnace certainly is not new, and the principal parts of the process appear to have been practised before, and perhaps the very mode may have been hit upon; but it does not signify how near the discovery former experiments have arrived, or even that they have produced the effect, if the persons practising these experiments have not known to what their success in a particular instance has been owing, and have been unable to practise or communicate any certain method of attaining the object. I take for granted that workmen will be produced to prove that the invention is not new, but it is so improbable that opulent companies engaged in the business of manufacturing of iron should neglect such a source of profit if they knew of it, and that it should be considered by scientific men of the first eminence down to the time of Mr. Cort's patent as a great desideratum in the art yet unattained, that I should suppose that sort of evidence would either be weak in itself, or would not receive much credit. If Mr. Cort's patent has any validity I think it will exclude the Coalbrook Dale Company as much as any others, for their patent is of no importance unless they had discovered the process, and if they had, then, whether it was described in their specification or not, Mr. Cort's patent would be of no validity. It seems to me that if Mr. Cort determines to enforce his patent, and to bring actions for infringements upon it, he had better contend with that company than with any others; for their conduct affords many circumstances which could not so well be given in evidence in a contest with others, and which may be very material; and besides, if Mr. Cort proceeds against persons setting up a rival patent, and pretending the merit of first discoverers, it is not very likely that others will hereafter contest the point with him.

(Signed) "A. CHAMBRE, Gray's-inn.

"4th March, 1785."

The Carron Company, by letter dated the 18th of February, 1786, invite Cort to their works: —

"Carron, Feb. 18th. 1786.

"John Wanchope, Esq.

"SIR,—We have taken into consideration your letter of the 9th, respecting our engaging to manufacture bar iron under Mr. Cort's patent. Should he enter into contract with Government for the furnishing of that article, we now beg leave to acquaint you that we should be very ready to accommodate Mr. Cort with our works in the following manner: —

"We would, in the first place, sell Mr. Cort our pig iron to any extent he may have occasion for at a stated price, and deliver it at the forge.

"In the next place, we would either rent him out the forge for a certain sum of money annually, or if it were thought more eligible at a fixed rate per ton on the quantity of iron manufactured. In either case we would uphold the forge and make good the wear and tear.

"Mr. Cort should then have the entire direction of the forge, both as to the mode of his operations and as to the workmen that should perform them. He might either bring down his own people or take such of ours as would answer his purpose. In this situation Mr. Cort would be perfectly at ease and undisturbed as to his pursuits; and he alone would be answerable for their success.

"Under such circumstances Mr. Cort might make use of our name to the Public Boards in order to convince them of his abilities to deliver the quantity he contracts for; and no doubt it must be from a connection with such extensive works as ours that he can prevail upon the Board to entrust the supply of their yards to a British manufacturer of bar-iron.

(Signed) "C. GASCOIGNE."

The following letter from James Black, the brother of Dr. Black, to Lord Stanhope, affords independent testimony as to what was going on: —

"28 Mincing Lane, May 24th, 1786.

"MY LORD,—By your permission, I have the honour of waiting on your lordship with the enclosed letter from my brother, containing his reasons for approving Mr. Cort's process to make bar iron.

"I was with Mr. Cort yesterday two hours, who related to me that a quantity of ballast iron had been delivered to him by order of Government, which he had converted into bar iron under three of their inspectors. That several anchors had been made at and in the principal dockyards; and other chain-bolts, &c., &c., of the said iron. That similar anchors, &c., had likewise been made of the best Swedish iron called Orgrounds. That comparative trials have been made at several of the dockyards. Mr. Cort, from the minutes he has taken, and which he showed me, has the fullest proof by experiment of his iron possessing every quality of the above-mentioned Orground Swedish iron, and of its surpassing the quality of that iron in toughness and strength. Mr. Cort proceeds to Portsmouth and thence to Plymouth, where he has reason to expect the same result in his favour, as the iron is the same. I took the liberty of mentioning to Mr. Cort that I had no doubt of his having established by the fullest experimental proof the quality of his iron; but that it now remained with him to establish the cheapness of his process by comparative experiments equally well ascertained. He said that so soon as he had finished what he was about he would immediately set himself to prove the cheapness of his process; in which he said he had no doubt of his success, upon grounds as incontestable as those on which he has established the good quality of the bar iron manufactured by his process.

"I hope this communication may be agreeable to your lordship, and I have the honour to be very respectfully,

(Signed) "JAMES BLACK.

"P.S.—Your lordship will be pleased to return me my brother's letter."

The *Scientific American* states that one of the newly-constructed locomotive steam fire-engines lately ran twenty miles on a common road. The whole weight of the engine, water, and nine passengers, was 12,000 lbs., 9,000 lbs. being the weight of the engine alone. The first three miles were made in sixteen minutes running time, and it went over a bridge 350 feet long, with a draw of forty feet in the centre, and up a very heavy grade, making 1,000 feet in exactly one minute. The time occupied in travelling the twenty miles was two hours, glades and all included.

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THE WESTMINSTER CLOCK.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—It is now more than two years since the controversy between Mr. Denison and myself concerning the Westminster clock and bell appeared in the *Journal of the Society of Arts*, the MECHANICS' MAGAZINE, *Builder*, and some of the daily newspapers. That controversy, which was commenced in November, 1856, in the magazines, contained suggestions which would have prevented the principal failures that have since occurred if the Government had acted upon them. Some of the subsequent failures have become public: but the persons responsible for them have ungenerously shifted the blame from their own shoulders on to others. The question of who is responsible for the failures was mooted in the House of Commons on Friday, 15th July, and as no satisfactory answer was elicited, I purpose supplying the deficiency to some extent in this and a subsequent letter. And in doing so, perhaps I should claim some credit for forbearance when the first bell was broken, in not then calling attention to the fact of the bell having been destroyed by the clapper, which, throughout the last controversy, I had pointed out as being so enormously heavy compared with the weight of the bell and the size of the clock that was to work the equally disproportionate hammer. A reference to the publications already mentioned will show that the *tone* in which my statements were contradicted was sufficient to have justified the earliest opportunity being taken of recurring to the subject after events had confirmed my opinions.

The easiest way of arriving at the difference between what the clock was to have been and what it really is, will perhaps be to go through the excellent conditions originally laid down by the Astronomer Royal for the construction of the clock, and select the chief of those which have not been fulfilled. The first condition not fulfilled is the one which required the wheels to be made of hard gun-metal, with the teeth cut to the epicycloidal form. Instead of this the wheels have been made of cast-iron, which is the cheapest material that could be used, and the teeth have been cast in, instead of being cut, whilst a large sum has been added in the contract for the change, under the plea of the extra labour required in cutting and working cast-iron: whereas it now appears that the wheels are destitute of the promised workmanship, and that they are merely left from the casting. These deviations have been effected at Mr. Denison's instigation, and he is the person responsible for them. A second condition required the escapement to be the dead beat or something equally accurate. Instead of this the escapement employed is a modification of the gravity escapement, which in its most perfect form has occasionally been proved to fail even for small astronomical clocks; and as the power in the Westerminster clock must of necessity be some hundreds of times greater, its employment there is certain to result in failure. For this deviation Mr. Denison is responsible. A third condition required that the minute hands should move over the half minute or minute space at once, so as to enable the time to be observed outside within a second. The plan for carrying out this condition has so completely failed that the condition itself has been abandoned. Mr. Denison designed the plan and is responsible for its failure. The forfeiture of this condition is remarkable, for it is the one concerning which Mr. Denison ridiculed Mr. Vulliamy for hesitating to carry it out. A fourth condition required that the first blow of each hour should be accurate to a second of time. To fulfil this condition the going part should be capable of keeping time within a second for 24 hours at least: but the pendulum is only compensated with zinc; and the enormous surplus force required to drive the hands in all weathers will occasionally reach the escapement and cause it to trip or run forward, and the hands to be in error, to the extent of either seconds, minutes, or hours, as the case may be; thus introducing a source of inaccuracy to which gravity escapements are especially liable, and one from which the dead escapement is entirely free. Mr. Denison is responsible for the plan adopted. A fifth condition required the clock to go and strike eight days with one winding up. Instead of this the arrangement had failed to the extent of reducing it to a four day clock some time since, with the probability of its requiring to be wound up still oftener. For this failure Mr. Denison is responsible.

Another condition appeared in the agreement with Mr. Dent which required that the clock should be completed and going 12 months in its place to the satisfaction of the Astronomer Royal and Mr. Denison before being paid for; and by finished and going it was of course understood that all the parts of the clock were included, namely, quarter part, hour part, and going part. Yet, notwithstanding this, Mr. Denison gave his certificate, and caused nearly the whole of the contract money to be paid to Mr. Dent's successor more than two years before the clock had been fixed in the building at all, under the plea that the going part alone had been acting satisfactorily in Mr. Dent's shop waiting for the bells; but this was without either the hands and *motion work* or the hour and quarter parts being attached, and under none of the disadvantages of strong winds, snow, and frost, which will exert considerable influence upon them when at their great elevation. In fact, to have taken the trial in Mr. Dent's shop as the test of what the clock was capable of doing, was like trying a locomotive for its power without attaching any train to it, and taking the speed it was able to attain as the result which might be expected when encumbered with its compliment of carriages.

The last failure publicly announced is the extreme weight of the minute hands, which the first commissioners of works has stated in the House of Commons to weigh more than 3 cwt. each. This weight for a minute-hand of only 11 feet radius is incomprehensible, even when allowance is made for the fatality which seems inseparable from the Westminster clock. Instead of 3 cwt. the hands should not have weighed 1 cwt. each; and if the metal had been disposed in the best form for giving the greatest strength with the least weight, they would have been amply strong enough with considerably less than 1 cwt. of metal in each. The First Commissioner of Works added that lighter hands were about to be made, and that it was probable the clock would then work all the four dials in a satisfactory manner. But this anticipation, like others of the past, will certainly be disappointed, for, after computing the weight which suitable hands, counterpoises, motion work, &c., must necessarily amount to for four dials of this size, and allowing for the additional influence of high wind, frost, and snow, the force required to overcome the whole will be so great compared with the weight of the pendulum, and the small force which will be capable of disturbing its time, that there does not appear to me any possibility of the clock maintaining a constant rate within several seconds a day, even though a dead escapement should be substituted for the gravity escapement to prevent tripping, and supposing the clock can be made to go continually thereby. And considering further that other sources of error will prevent the pendulum being increased so as to meet the difficulty, I am quite convinced that a clock with four dials this size can only be made to keep a rate within a second a day, by a similar plan to the one patented by myself, which I submitted to the Astronomer Royal for adoption in the Westminster clock several years ago; but Mr. Denison had then so far usurped the control over the clock as to prevent any plans being adopted besides his own. In this plan the power employed to drive the hands is completely cut off from the escapement and pendulum which regulate the time, and a small astronomical clock, with all its accuracy and durability, is employed for the time-keeping part, whilst the power available in the large clock for driving the hands may fluctuate even to the extent of 100 lbs. at the diameter of the centre wheel without affecting the time half a second a day. The plan, moreover, allows the Astronomer Royal's condition to be easily fulfilled for enabling the time to be observed to a second by the exterior minute hands moving quickly over the space of 14 inches once a minute.

The difficulty that was likely to occur from Mr. Denison's plan of regulating the going part by a gravity escapement in direct communication with the hand *train*, was pointed out to the late Commissioner of Works last February, and in the same letter I offered to undertake the superintendence of the clock, in order to introduce the improvement just mentioned and carry it to successful completion, but the reply seemed to indicate that the Board had not then power to change the superintendence. In fact, Mr. Denison boasted in his book, nearly two years ago, that the Board had taken no less than five opinions from the Attorney General, the Solicitor-General, and the other law officers of the Crown, to try and "get rid" of his superintendence without being able to do so, and the parliamentary papers show that the law officers were consulted with that object in view.

Concerning the cost of the clock, a great deal of credit has been claimed for the lowness of Mr. Dent's tender as compared with those of Vulliamy and Whitehurst, and the difference between them has formed one of the principal reasons for giving the contract to Mr. Dent; but we now see that the clock once secured, with Mr. Denison as referee, all idea appears to have ceased of its being carried out according to its original conditions, upon which the others tendered, and a much easier way is adopted of making up for the low tender. Mr. Denison, having fairly established himself in the double position of designer and referee, acting professedly for the Government, begins the process by causing the material to be altered from expensive gun-metal to cast-iron, and the contract price instead of being lowered, to be raised from £1,600 to £1,900, partly under the plea of iron being more expensive to work, and then the next step is to dispense with the said workmanship altogether, but retain the full price in the contract, thus evading not only the original workmanship which gun-metal wheels would have necessitated, but the additional labour of cast-iron, for which the extra sum was added. And then, as each failure occurs in the plans of Mr. Denison, the *designer* and the Astronomer Royal's conditions of construction are sacrificed after each other; Mr. Denison the *referee* is ever ready to put a bold face on the matter and pronounce the sacrifice of the conditions as really the best thing that could have happened, and modestly intimates that the Government is fortunate inhaving the man "who understands the subject better than any one else in England." Mr. Dent's original estimate for the entire clock was, as we have seen, £1,600, but what the sum may have reached under Mr. Denison's management, now that the principal advantages of the clock have been sacrificed, there is no available evidence at present to show.

Having briefly sketched the failures that have occured and those which are likely to follow, with regard to the clock, and shown who is responsible for them, I purpose giving a similar sketch concerning the bells in my second letter.

Yours, &c., E. T. LOSEBY.

30th July, 1858.

THE NEWCASTLE PUMPING ENGINE.

GENTLEMEN,—IT is impossible to help admiring the beautiful simplicity of this engine, as described in your last Number, but I cannot imagine why the double-acting pump was not placed behind the steam cylinder, instead of in front of it. An ordinary horizontal high pressure expansive and non-condensing engine might have been used with some advantage, the piston rod being carried through both ends of the cylinder, and connected by some tolerably good non-conductor of heat to the end of the pump rod of the double-acting pump placed behind the cylinder. By this means the present difficulty of the connecting would be obviated, and the usual tendency of an horizontal cylinder to wear oval would be greatly diminished by the stuffing-box at each end of the cylinder being bushed with brass, and receiving a good part of the weight of the piston. W. H. C.

London, August 10th, 1859.

ASSOCIATION OF FOREMEN ENGINEERS.

On Saturday night last this Association met at their rooms in St. Swithin's-lane, City, Mr. Joseph Newton filling the chair. It had been announced that a member would read a paper on "Superheated Steam," and as this happens to be a subject of peculiar interest to the gentlemen who comprise the Association, a very numerous body assembled on the occasion. A dissapointment, however, was in store for them, for after the ordinary business had been gone through, the Chairman announced that a letter had been received a day or two previously from the promiser of the paper, stating his inability—from illness—to redeem his promise. Mr. Newton, however, further announced, much to the satisfaction of his auditors, that under pressure of the emergency he had summoned to his aid the services of a friend, a fellow-member, who at the eleventh hour had nobly come forward and written a paper on a totally different matter, the "Manufacture of Rifles, with a description of those death-dealing weapons," which he was prepared, if acceptable, to read. Consent was readily given, and the gentleman, whose maiden attempt it was, and whose modestly declined to have his name published, read his very elaborate paper on this subject. It was at once a clear, practical, and tersely written essay, and conveyed much information of a novel character to the bulk of the members. At its conclusion the applause was general, and after a very enlivening discussion, in which Messrs. Keyte, Ives, Stabler, M. Jones, the Chairman, and others joined, a vote of thanks was given by acclamation to the expounder of the rifle. Mr. Newton, in proposing this vote, took occasion to eulogise the writer of the paper, and to incite other members to emulate his zeal. An adjournment to the first Saturday in September followed, and the meeting was at an end.

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JENSEN'S MARINE ENGINE GOVERNOR.

FIG. 1.

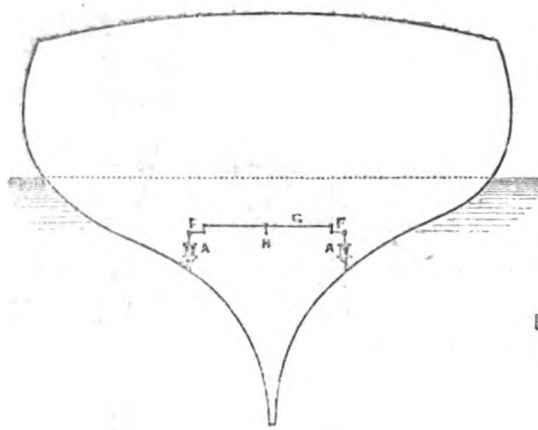


FIG. 2.

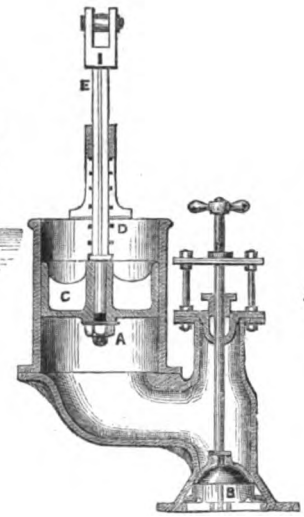
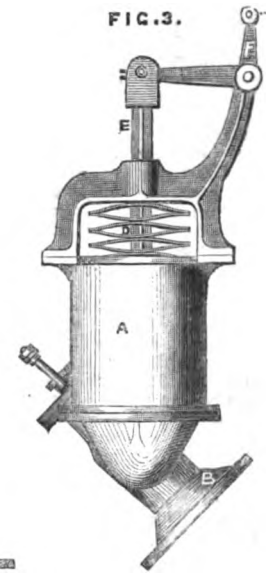


FIG. 3.



JENSEN'S MARINE ENGINE GOVERNOR.

By Mr. PETER JENSEN, of Copenhagen.*

THE engines in very large screw steamers with deep draught are considered to work with sufficient regularity even in a gale, as the size and weight of the ship to a great extent prevent it from pitching; and for this reason no great difference in the depth of immersion of the screw takes place: but, except in the above case, serious irregularity is experienced in the working of marine engines in a heavy sea, when the screw or the paddle wheels are one moment deeply immersed and the next moment revolving half or more in the air. A waste of power then occurs; for although in a given time the same amount of power is supplied from the boiler, whatever the speed of the engines may be at any moment, still the power is not exerted in an advantageous manner whenever the propeller is only partially immersed, as it then presents too little surface of resistance to the water, and is consequently not able to propel the vessel so efficiently as when immersed to the proper depth. In most marine engines, therefore, instead of the consumption of steam being reduced by saving the steam when it cannot be used to advantage in consequence of the propeller being only partially immersed, it is at that time wasted in driving the screw or the paddle wheels with great speed in a light draught of water, and a great amount of slip or loss in effective speed of the vessel consequently ensues. In applying a governor to marine engines economy of power must result, as in the case of stationary engines. Moreover, most of the accidents occurring to marine engines are due to the sudden shocks that will happen during a gale even in well-balanced engines. The lubrication is also often rendered difficult, because the oil is thrown out of the cups; and the great amount of wear and tear in marine engines may be attributed partly to the shocks and the irregular motion, and partly to the more imperfect lubrication.

Marine engine governors have been attempted on several occasions, but only very few are yet applied. An ingenious modification of the ordinary Watt's centrifugal governor has been employed for this purpose, Silver's four-ball governor, in which the action of a spiral spring is substituted for that of gravity, and the whole apparatus is balanced so as to remain undisturbed in action during the pitching of the vessel. But the mode of action of all such governors is by checking the supply of steam to control the speed of the engine after it has begun to change either to quicker or slower: and it has appeared to the inventor of the governor forming the subject of the present paper, that the principal desideratum in a good marine engine governor is an instantaneous action, so that whenever the screw or the paddle wheels are going down in the water more steam may be admitted to the engines as quickly as possible, and in the opposite case the admission of steam may be as quickly as possible checked, before the speed of the engines has been sensibly affected. For attaining this object it seems more natural to make use of the cause of the evil as a remedy against it, or to employ the irregular motion of the vessel as a means of regulating the engines. than to let the engines regulate themselves. By this means an intermediate step is dispensed with: and by making use of the non-elastic water as the motive power of the governor, the action will be exerted quickly enough upon the engines to regulate the supply of steam before the depth of immersion of the propeller has been materially altered by the pitching of the vessel.

The construction of the new Marine Engine Governor is shown in the engravings. Fig. 1 is a transverse section of the vessel showing the governor in position; and Figs. 2 and 3 are a longitudinal section and elevation of the governor enlarged. A cylinder *A* is placed at each inner side of the vessel below the water line, the bottom of the cylinders communicating with the water outside by means of the Kingston valves *B*. Each cylinder is fitted with a piston *C*, which is loaded with a spring *D* either of steel, compressed air, or india-rubber. The piston rods *E* act upon bell crank levers *F F*, and by means of connecting rods *G G* motion is given to a common spindle *H*, from which the throttle valves of the engines are worked in such a manner that when the pistons *C* go down the throttle valves are closing, and when the pistons go up the valves are opening. Now as the pressure of the external water increases in proportion to the depth when the openings of the valves *B* come into different depths in consequence of the pitching or rolling of the vessel, the pressure on the pistons *C* will be changed proportionately; and to each pressure will correspond a certain position of the pistons and of the throttle valves connected with them. Omitting the pitching of the vessel in a paddle-wheel steamer, and considering only the rolling motion, it is obvious that when one paddle wheel is deeply immersed and the other nearly or entirely out of the water, the pressure on the two pistons will be different; but supposing them connected together, the position of both and of the throttle valves will be then corresponding to the difference of resistance on the two paddle wheels.

If these cylinders are placed as near to the propeller as convenient, so as to ensure pretty nearly the same depth of immersion, it will be seen that this apparatus will then act as a governor for the engines: for when the propeller is revolving in a light draught of water, the supply of steam to the engines is proportionately diminished; and when revolving in deep water, the supply of steam is proportionately increased. The whole arrangement is simple, as shown by the drawing, and the cost small, probably not exceeding four or five shilling per horse power.

* Read at a late meeting of the Institution of Mechanical Engineers.

THE SCIENCE AND ART DEPARTMENT.

THE sixth Report of the Science and Art Department of the Committee of Council of Education was printed on Friday in the form of a blue book of some 150 pages, compact and portable. The geological survey of the kingdom is first noticed. The number of square miles surveyed in the past year, in Great Britain, has been 2,326, while in 1857 the area was 2,605. In Ireland the work of survey has been chiefly directed to preparing for publication the 1-inch maps of that country. Professor Huxley and Mr. Salter have worked diligently in the "Natural History" and "Palæontological" departments of the survey. The Museum of Geology was visited by 24,877 persons last year. The Mining Record-office continues to increase in importance and usefulness. The Government School of Mines is prospering, and several kinds of assistance have been afforded to other departments of Government by Dr. Hofman (the lecturer on chemistry) and Dr. Percy (the metallurgical professor). One of the pupils of the school, a Mr. Charles Gould, has been appointed to the office of Geological Surveyor of Tasmania. The Museum of Irish Industry was visited by 23,638 persons. The number of visitors at the gardens of the Royal Zoological Society exhibits a large increase, a result attributed by the hon. council to "the increased attraction which a large addition to their stock of animals has enabled them to bring before the public." The various local schools of art, drawing, &c., appear to be flourishing, and the Metropolitan Public Schools for the Poor are growing rapidly. The Circulating Art Library of the South Kensington Museum was open for 289 days last year, and is very extensively used; 500 volumes have been added to the collection, and upwards of 1,300 prints and 600 photographs acquired. The Circulating Museum Collection visited six towns last year, and proved very attractive. The Museum at Kensington is replete with objects of interest, almost too numerous even to be glanced at in passing. The high rate of attendance at this Museum was fully maintained in 1858. A monthly average of 38,000 was maintained, and the total number for the year are upwards of 456,288, of whom

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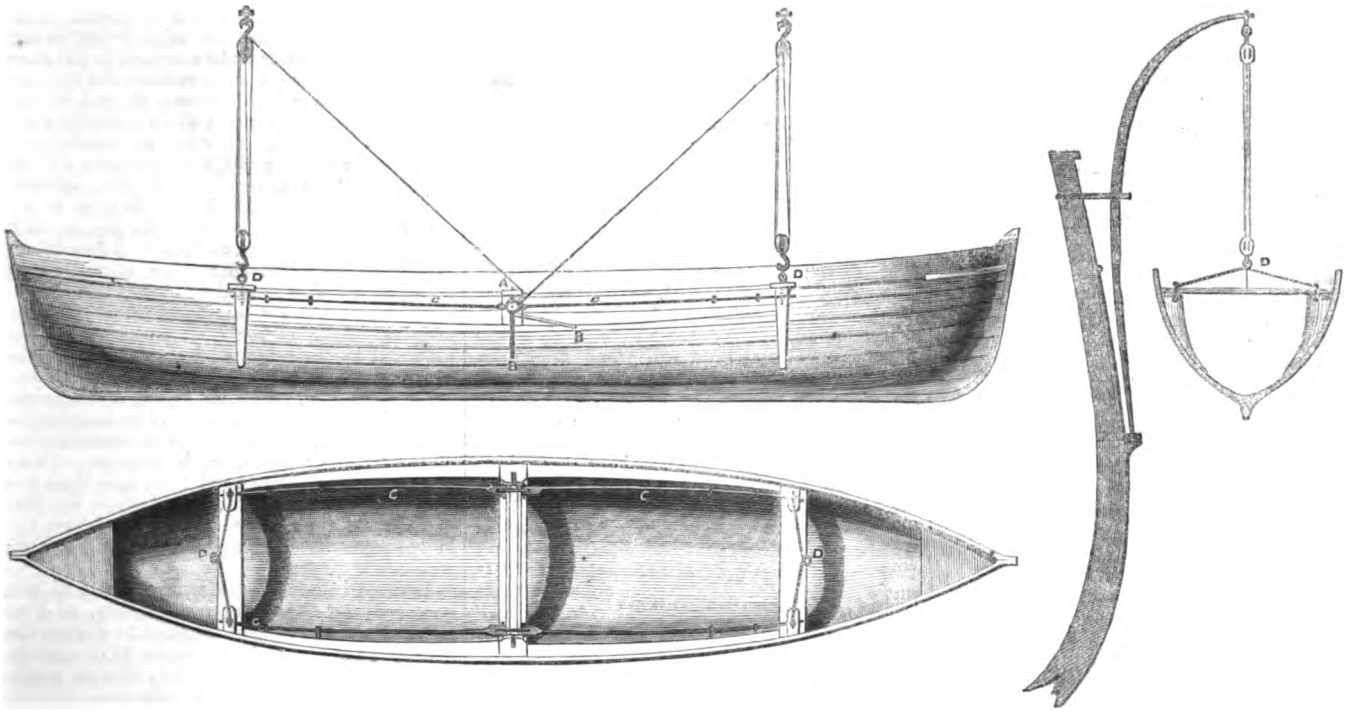
WOOD AND ROGERS' BOAT-RELEASING APPARATUS.



47,082 attended on what was called "students'" (not free) days; 237,272 attended in the day, and 219,016 in the evening. The public lectures appear to be useful and instructive. The results of the working of the Department of Science and Art in all its divisions, for 1858, exhibit a great increase on the previous year in the attendance of the public at the museums, schools, and lectures. The visitors to the various museums, &c., in the three capitals of the United Kingdom, under the superintendence of the Department, amounted to 875,898, equivalent to an increase of 117,923 on the previous year. The committee can state with confidence that at no period since the Department has been founded have its condition and working been so sound, or the public appreciation of the advantages which it offers in aid of private efforts to promote science and art among all classes so marked as in 1858.

WOOD AND ROGERS' BOAT-RELEASING APPARATUS.

THE accompanying engravings illustrate a new arrangement of apparatus for disconnecting both ends of a ship's boat simultaneously from the lowering tackle, invented by Mr. Wood, an officer of the Peninsular and Oriental Company's ship China, and Mr. Rogers, of Green's Dockyard, Blackwall. In the opinion of Mr. Wood, as he informs us by letter, the manœuvre of disconnecting the boats when lowered by the tackles within a safe distance from the water should be left to the judgment of the boat's crew, according to the rolling of the ship and the prevailing state of the weather. "My method," he says, "does not embrace the lowering of the boat, presuming that to be under control of careful hands on the ship's deck. I will, if required by any patrons of this method, so arrange the boat-tackle falls inboard the ship, by connecting them on one roller or leading through a block, as to insure the falls easing off equally and together, thereby compelling the boat to lower on an even keel; and, by shortening the stern rods of the after end of the boat, cause the after slings to be thrown off slightly in advance of the bow slings, and allow the boat to enter the water a little by the stern." "I have brought this out," he adds, "as a practical nautical man, and from experience of other methods in use have adopted this for security and less risk of losing boats from the davit-head suddenly altogether."

It can hardly be necessary for us here to discuss the relative merits of the two methods of releasing—by the lowering fall, as in Mr. Clifford's plan, or by an independent apparatus as in Captain Kynaston's, and the new plan now before us. For some time to come, officers will doubtless be found to prefer each of them.

The engravings show the new plan very completely.

A is the norman or lock bolt to be withdrawn whilst lowering from the davits. *B* is the lever handle for heaving round the barrel, by which action simultaneously four rods or bolts are withdrawn from either end, setting free the slings by which the boat is suspended. *C C* are the long rods or bolts that are worked by the barrel, secured to the sides by staples or cleets as required. *D D* are the slings; they can be made of rope-wire, rope, or bar-iron, with eyes in each end to receive the bolts. In lowering the boat, if the ship is under way, the after-tackle should be lowered slightly more than the bow-tackle, so that the rudder may have all power over the boat to sheer her off immediately from the ship's side, and clear her if the ship is propelled by a screw; if the screw enters the water on the side the boat is hung, it is more liable to suck the boat towards the propeller, and *vice versâ* if the ship is going astern or reversing with the engines. The boat should be let free from the tackles when about one foot or nine inches clear of the water.

BOAT-LOWERING APPARATUS.*

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Having candidly admitted the unfairness of continuing to publish correspondence attacking me when unauthenticated by the name of the writer, and having stated your intention to decline doing so again, I shall of course confine myself, as far as this subject is concerned, to answering once more, and for the last time, what "Nauticus" advanced in his last letter to you.

When he first alleged the loss of a boat's crew through the use of my lowering gear, I challenged him to name the instance to which he referred. He replied by stating that it occurred to Messrs. Green's ship, the Orwell, that "the fore pendant hung when the boat was at the water's edge, and the whole of the crew were drowned in consequence." On the authority of Messrs. Green (after they had themselves instituted inquiry into the circumstances), and also on the captain's, I showed that this statement was not true, and that the accident to the boat's crew was "*not in any way attributable to my lowering gear.*" Any further particulars would have been merely superfluous, but it appears to have answered the purpose of "Nauticus" to relate the details of the catastrophe over again, and still to labour to attribute the cause to my lowering gear.

It certainly is a fact that ought not to be lost sight of, that the entire exculpation of my plan on the occasion in question proceeds from a firm that never used it through any feelings of friendship to me, or interest in the invention itself, but under the compulsion of Government. I may therefore justly claim the full value of all they state in my behalf. Evidence from such a source cannot be summarily set aside by mere assertions, even if advanced by "an original informant of rank and position" (but whose name, like that of "Nauticus," is withheld), and who, by the showing of the latter, stated one untruth at least when he declared "*the whole of the crew were drowned.*" One of the two men who were not drowned, and who were in the boat at the time it was lowered, stated positively in evidence that "*the patent did not foul.*" I may further add that the attention of Captain Lean, R.N., the chief emigration officer of the city of London, having been directed to this case (not by Messrs. Green, the parties interested), I have been given to understand the result of his inquiry was, that in this misfortune "no blame whatever was to be attributed to the apparatus."

My plan or any other can do no more than safely lower a boat on to the water, and this it did in the instance referred to, in a heavy snowstorm, with such a sea running that it was a source of wonder to those on board that the boat ever lived through it at all even when on the water, and when the officers of the ship generally admitted that any attempt to lower a boat ought not to have been made; and it is a sufficient testimony to the soundness of my system that after having been fitted in at least a *thousand boats* during the *last four years*, the only case of failure with a fatal result that can be set up against

* Space could not be found for this letter in our last Number, or it would have appeared there.—EDS. *M. M.*

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it by opponents having other interests to serve is this miserable one of the Orwell.

That my plan stands alone in the proofs of practical utility it has shown by the number of lives saved I now repeat. Take, for instance, Her Majesty's Ships, Shannon (on two occasions), Racoon, Chesapeake, and Perseverance; from steamers of the largest class, Australasian (on two occasions), Queen of the South, and Indiana; from sailing ships and other steamers, the Commodore Perry and Champion of the Seas (ships of nearly 2,000 tons each); the Washington Irving, Blundell, Black Eagle, Ebba Brahe, Omega, Medway, Queen, Transatlantic, Admiral Boxer, Grand Trianon, Lady Mc Naghten, Rodney, Duke of Rothsay, and several others I cannot now call to mind. From all these ships have lives been saved, and nearly always under circumstances of considerable difficulty, often in the severest gales, and almost universally from vessels under steam or canvas. In two of these cases the entire crews of the ships have been preserved by its instrumentality, and on several occasions more than one human being at the time. All these cases are vouched for by the officers of the different ships. At the memorable preservation of the steam troop ship "Sarah Sands" (when half consumed by fire) Captain Castle has publicly recorded its "perfect efficiency" in lowering the life-boats filled with the women and children, when he says that by "the ordinary method he would not have attempted such a thing;" and the captains of the Eastern City and Merchantman also bear their written testimony to a like result, when the former ship was entirely burnt. Only during the last few days two other cases have reached me, one from Her Majesty's ship "Archer," on the coast of Africa, about which an officer on board writes, a "few days since a man who fell overboard was saved from the sharks, thanks to Mr. Clifford's apparatus;" and the other from a Scotch steamer, in which the same gear has been in use for two years. The carpenter fell overboard from the sponson in the night, vessel under full steam, but was instantly picked up. The last case proves that time, as "Nauticus" states, has not been such an enemy to my system. Captain Morris, of the late "Eastern Monarch," only this week writes me also of a boat lowered for a like purpose under most trying circumstances with perfect success. It is not from arrogance I have mentioned these instances, but only in reply to one who uses that term for no other purpose than to injure me; and I have a right to ask if any equal list can be shown by any other inventor?

The imaginary parallel that "Nauticus" fabricates about the patent safety lamp for the purpose of detracting from the value of positive evidence that he cannot disprove, needs no answer from me.

It is not a fact, moreover, as he states, that "my desire for competitive trials was forestalled," for since I first turned my attention to this subject, eight years ago, I have urged upon the Government the public good that must result from such a course being taken by the proper authorities, and the right that every inventor had to a like opportunity of proving the efficiency of his system. I felt this the more strongly as for some time I was refused a trial by the Admiralty at my own expense; but which, like other inventors, I might have obtained if I had courted interest or patronage. But I have never sought advancement by such means, and I will not begin now. I have had no friend high in the service to open the door for me, or to sue in Parliament for a dignity or a recompense when the first life was saved by my gear. No one knows better than I do how seriously the want of professional standing adds to the uphill work of prosecuting such a cause as I have had in hand; and, however gratifying it may be to one of "Nauticus'" position to refer to "a person of an opposite calling," it is some testimony to the intrinsic value of my invention that, with this dead weight, it has reached its present position in the public estimation, and the different departments of the Government.

Boat-lowering safely in heavy weather is no theory; it is a hard matter of fact, and the difficulties to be surmounted purely mechanical, and he must evidently deserve the first place who can give the most practical proof of efficiency. While the fleet is in the Channel or off Spithead, let the Admiralty order a series of public trials to be instituted; not a casual lowering or two now and then under particular officers, who may happen to be relatives or personal friends of one of the competitors, but such a series as will afford a sure and certain proof of the relative qualities of any improved system, and let those be visible to the profession and the public.

In the heavy sea-way, and from the rolling or pitching ship, whether at anchor or under way, such things are most wanted, and it is under such positions they should be tried. If the Admiralty or "Nauticus" will endeavour to bring about this end, more national good will result than from columns on columns of argument; and when such an occasion is afforded, results will prove whose theories are mere theories, and whose deserve a higher appellation.

The way in which your pages have always been open to discussion on this important subject merits the warmest thanks of the seaman, and I trust that in your desire to steer clear of purely personal controversy which can never benefit a public cause, you will not hesitate to find space for any who strive to fix public attention on the present neglected state of boat lowering, but will yourself urge as you have heretofore the imperative necessity of the *Admiralty's* taking the lead (as it should do,) in the movement now happily going on, for benefitting the hard fate of those "whose lot is cast upon the waters," by ensuring for them the advantages of an *efficient means of lowering the boats* in every ship that puts to sea, and visiting with deserved punishment all who, having such means on board, neglect to keep it in proper working order, and available at the required moment. Whilst their lordships give every encouragement to any new means for the destruction of human life, surely they will make some effort to help its preservation, and let the seaman see that the better feelings of human nature find a place for him in the breasts of his superiors and officers, and that in the hour of need he will not now be left as heretofore to struggle and sink into eternity because official lethargy and indifference withheld the means that might have saved him.

Yours, &c., CHARLES CLIFFORD.

August 2, 1859.

ELECTRIC TELEGRAPH CABLES.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—May I beg the insertion of a few remarks on a letter which appeared in your journal of last week, from Messrs. Hall and Wells, on the subject of my telegraph cable.

It appears that my letters to them respecting their infringement of my patent, which were essentially of a private character, have induced them to adopt the strange course of attempting publicly to disparage my invention, and repudiate my claim. I hardly know whether Messrs. H. and W. are fishing for information upon the subject about which they confess they are "puzzled," or whether they have fallen into the error of imagining that I am not myself a practical man, and that I had not fully provided for all the *little difficulties* which to them at present appear insurmountable. I admit the fact, in my specification, that wires have been sometimes covered with fibrous substances previously to coating with the insulating material, but I deny that this process has ever been employed for the object patented by me. As for the portion of my patent, viz., the employment of porous or fibrous substances in conjunction with the insulating material, for which Messrs. H. and W. gave me credit, but of the practicability of which they seem to express doubts, although they are themselves actually infringing my patent by adopting a modification of the process, I can only tell them that the Gutta-percha Company will be ready when required to manufacture cables upon my plan without the slightest difficulty; and if Messrs. H. and W. should ever think of carrying out my process to the extent contemplated by me, adopting india-rubber as the medium of insulation, I shall be very happy, with a proper understanding, to put them in the way of doing so, as there is not the slightest difficulty in the matter. Messrs. H. and W. profess to be practical men; I will not dispute this; but I am afraid that they are not equally good electricians; hence perhaps their reason for the expression, "we cannot follow Mr. Hearder through such a multiplicity of ideas as to the construction of a cable under his patent, as it would be simply a waste of time." I may inform Messrs. H. and W. that other manufacturers differ from them in opinion, and certain electricians and telegraph engineers whom I might mention, of the very highest authority, are unmeasured in their terms of approbation of the plan. Lastly, I may mention for Messrs. H. and W.'s information, that being myself a mechanical engineer as well as an electrician, I have appliances for constructing any description of machinery required for the purpose, or, if necessary, of constructing the cable itself, and I can show them machinery much on the same principle as that described in their specification, which I have had in operation for covering and counter-covering wire nearly 20 years.

I cannot imagine that Messrs. H. and W. can have read my specification attentively, or they certainly would not have ventured to dispute the *novelty of every part* of my process in its application to the intended purpose, viz., that of lessening the mischievous effects of induction.

I hope that my remarks will not be received as uncourteous; I have not the slightest desire to take any hostile position with regard to Messrs. H. and W., because from the samples of their cable with which they have favoured me, I can see plainly that much greater advantages would accrue from our co-operation, as my process can be carried out quite as efficiently with india-rubber as an insulator as with gutta-percha. The object which I have had in view has been to apply well recognised electrical principles to the improvement of telegraph cables, principally with a view of lessening the effects of inductive action, still also keeping in sight the attainment of desiderata which experience has shown to be necessary in the construction of new cables. One of my processes for accomplishing this object, is by embodying with the layers of insulating materials strands of suitable substances, twisted or braided, or laid on in any convenient and efficient way, and, if necessary, I braid or twist string over the whole cable, and render it waterproof.

My internal conductor, also, is made of dimensions suitable for affording the least resistance to the transmission of the current. I believe that no one acquainted with telegraph engineering will be prepared to deny that a cable carefully constructed upon this principle, would possess every quality that could be desired. It would be light, amazingly strong, as perfectly insulating as the best that have been made, and infinitely more free from the effects of induced residual discharges than any cable that has been, or can be made, upon any plan existing prior to my own. I am quite aware that the complete apprehension of the principles upon which my plan is founded, involves a rather more intimate acquaintance with electrical laws and phenomena than is possessed even by many "practical men;" but the careful consideration of them, however, by those competent to form an opinion, has resulted in the full recognition of the value and efficiency of my plan.

The specific gravity of this cable being very little greater than that of water, the simplest possible form of break would be sufficient to lay it, small weights being only necessary at intervals to facilitate its sinking when in deep water.

I remain, Gentlemen,

Your obedient servant,

J. N. HEARDER.

Plymouth, August 8, 1859.

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THE COMMITTEE ON DOCKYARD ECONOMY AND EFFICIENCY.

H.M. Dockyard, Portsmouth, 8th Aug., 1859.

SIRS,—Courtesy always permits a reply to a personal attack. The undue prominence you have given to my name with reference to the Report of the Committee on Dockyard Economy and Efficiency, requires that I should address you to disclaim that prominence, and to say that you have formed a very false estimate of the part taken by the other members of the Committee.

The Report may with much more justice be said to be based on the experience of Admiral Smart as Superintendent of Pembroke Yard—on the great and varied knowledge possessed by Mr. Laws respecting all branches of the Dockyards, obtained while serving as clerk in the Master Shipwright's Office, as Superintendent's Secretary, Store Receiver and Storekeeper—and on Mr. Bowman's knowledge and experience of the mode of conducting work in private shipbuilding and other establishments, in addition to the information obtained while serving on the Committee.

To your insinuations against my own character, I could easily reply, but knowing that your Editor Mr. Reed, who writes the ship-building articles in connexion with your journal, was a dockyard apprentice, and was educated within the last few years at the late Central Mathematical School under the system disapproved of in the Report, and his schoolfellows being employed in the Surveyor's office and in the Dockyards, I do not consider it necessary to do so, more especially as I feel that while your attempt to filch from us such good names as we may have will do your journal no good, it is not likely to do us or our Report much harm.

I am, Sirs, yours obediently,

ANDREW MURRAY.

To Messrs. Brooman & Reed, Joint Editors.

Law Case.

(Before Vice-Chancellor Sir R. T. Kindersley.)

THE DESICCATED MILK COMPANY (LIMITED) v. FADEUILHE.

This was a motion for an injunction to restrain the infringement of a patent for solidifying and preserving milk, under these circumstances:—It appeared that the plaintiff, Thomas Shipp Grimwade, took out a patent in 1855 for preserving and solidifying milk, which was effected by the following process:—The milk, being mixed with certain proportions of alkali and sugar, was then evaporated by being placed in a square tin tank with a chamber beneath, containing hot water, and constantly agitated by means of a crank and quadrant beneath, until the mass became of the consistence of dough. This dough was then dried into hard cakes, which were again crushed between powerful granite rollers and bottled, the bottles being closely stopped. It was then fit for use. The defendant, Valentine Bernard Fadeuilhe, was the assignee of a patent taken out in 1848 by Felix Hiacynthe Folliett Louis, whose process was of this kind:—Sugar and alkali being mixed with milk or with curd turned in the ordinary mode by runnet, it was placed in circular pans with false bottoms, communicating with three upright hollow standards, and a reservoir at the bottom, into which, by means of a valve, steam was introduced, and the liquid in each pan while evaporating was kept in agitation by means of a spindle passing through the centre of each with fluid-tight collars, to which spindle in each pan a rake was attached, the spindle being turned by a handle acting laterally upon a toothed wheel at the top of the spindle. The milk thus evaporated was formed into cakes, and the defendant, after a time, grated these cakes into powder and bottled it. This was in 1853, but subsequently to the date of the plaintiff's patent he admitted that he had dried the mass, but in ignorance of the fact that this method formed a part of the plaintiff's invention. The plaintiff, having discovered that the defendant was manufacturing and selling the article in bottles, drying it by a process similar to his, which did not form a part of the patent of Louis, filed the present bill to restrain the alleged infringement of his patent. It appeared that the plaintiff's invention had been extensively used at Balaklava, and by Miss Nightingale during her attendance on the sick.

Mr. Glasse and Mr. Bristowe appeared in support of the motion. Mr. Baily and Mr. Cadman Jones, for the defendant, were not called upon,

The Vice-Chancellor observing that, as it might turn out and must be assumed that the plaintiff's patent might be invalid, unless there was a user and enjoyment for a long time, he ought not to grant an injunction. The motion must stand over, with liberty to the plaintiff to bring such action as he might be advised, an account being meantime kept.

Our Weekly Gossip.

The Atlantic Telegraph Company have issued the following invitation:—"All persons having any specimens or plans of submarine cables calculated for laying across the Atlantic are hereby invited to send the same to the Secretary of this Company, together with any description they may desire to append to them, as soon as possible, in order to their being immediately submitted to the officers of the Company, and by them to the consulting committee, for the purpose of examination, testing, and experiment."

Arrangements for the meeting of the British Association for the Advancement of Science at Aberdeen are proceeding. The Prince Consort has fixed on Wednesday the 14th of September for the delivery of his inaugural address. The following Vice-Presidents have been chosen:—The Duke of Richmond, the Earl of Aberdeen, the Lord Provost of Aberdeen, Sir John F. W. Herschel, Sir David Brewster, Sir R. I. Murchison, the Rev. W. V. Harcourt, the Rev. Dr. Robinson, and A. Thomas Esq.; Major-Gen. Sabine will act as General Secretary, and Prof. Phillips as Assistant General Secretary; the General Treasurer will be John Taylor, Esq., and the Secretaries for the meeting at Aberdeen, Profs. James Nicol and Frederick Fuller, and Mr. John F. White. Messrs. John Argus and Newell Burnett will act as Local Treasurers.

Sir William G. Armstrong has been good enough to confirm the doubt expressed in our last number respecting the *canard*, or as he calls it, the "wild goose story" of a contemporary. He says, "Who made the wonderful shot that brought down a wild goose at six miles and seven furlongs? This is a question that meets me everywhere, and, disagreeable though it be to spoil a marvellous story, I am obliged to answer—Nobody. A wild goose certainly was shot by a shell from one of my guns at a distance somewhat short of half a mile; and, although half a mile is not to be regarded as the limit of safe distance for a goose to stand at, yet I am bound to say that six miles and seven furlongs is a range which as yet has only been reached with the long-bow." Honours and emoluments have made Sir William jocular—on the principle, we presume, that he may laugh who wins.

In consequence of the continued favourable reports from the Captains and Commanders of ships whose boats are fitted with Captain Kynaston's life-hooks, the Admiralty have given directions to the several Dockyards, says the *United Service Gazette*, that they are, for the furture, to be supplied to any Captain making application for them, without reference to the Admiralty. Captain Hillyar, of the *Cadmus*, has reported that during the voyage to Malta the boats had been lowered under every variety of wind and weather with perfect success. There is one very important feature in connection with this invention, which is the facility for applying the hooks to boats fitted on the old plan, in the course of a few minutes. They require no cumbrous machinery or windlass, and can be transferred from one boat to another without interfering with tackles or slings, while the cost of them is a mere trifle.

Mons. Barbedienne, of Paris, so well known for his bronzes d'art, and who received the highest medals for his works, both in 1851 and 1855, says, in writing to his correspondent in London, under the date of July 31st:—"Now that peace appears to become more firm every day, will it not be possible to return to your project for the exhibition of 1861? It appears to us that it is the duty of commerce and industry to rely with confidence on the interests of nations, and to discard all foolish and transient causes of antagonism and strife. In the actual state of things, a Great Exhibition in London would have a double salutary effect, both in the industrial as well as in the political world. Personally, I will do everything in my power to promote so noble and excellent a cause."

A drinking fountain or two, for the splendid and extensive pleasure grounds for the people at Kew, is now, from the very great numbers flocking to them, very much required: till such a needful want is supplied, a delicious glass of pure spring water may be had (gratis), we are requested to state, by all visitors, of the official attendant in livery in charge of the lower room of the new museum, opposite the palm house in the botanic gardens.

Mr. Hearder, the well-known electrician and engineer, favours us with the following:—"Gentlemen,—In compliance with the wish of your correspondent, Mr. Chick, I have pleasure in explaining to him the cause of the result described by him in connection with his induction coil in your issue of July 29th, which to him appears so novel and curious. It simply indicates that his battery had not surface or rather quantity enough to fill, if I may use the expression, his thick No. 10½ primary coil. He will obtain still more exalted effects by making the number of plates in his second series equal to those of the first, which is equivalent to doubling the surface of each plate. Your correspondent does not say whether his graphite battery is a nitric acid one, or whether it is simply excited by sulphuric acid without a diaphgram, after the manner of Smee's. If the former, he will find that if he employs his series of 12 in a double set of six, or perhaps even better, in a triple set of four, he will get still finer effects. Twelve in series give him more intensity than his coil wants. Hoping that this will meet the wishes of your correspondent, I am, &c., J. N. HEARDER. Plymouth, Aug. 6, 1859."

Some Sheffield correspondents send us the following:—"It is a allowed by all parties that the defences of this country against foreign aggression are in a very unsatisfactory and undesirable state. But we think they may be put in a more safe one at a comparatively small cost. We have to propose that a sufficient number of iron vessels made shot and fire-proof rams, built to strike the enemy's vessel under the water line, and to be built as low as possible above the water line, so as to be lower than the enemy's fire, to be of the greatest speed. These vessels to be armed with powerful fire-engines to throw liquid inflammables (such as coal, naptha, turpentine, mixed with coal, tar, and phosphorus, &c.) into and upon the enemy, which may be done in hundreds of jets through small port-holes. By this means, in less time than it takes to write this sentence, the enemy might be enveloped in one entire sheet of flame. These fire-ships to be stationed at the entrance of rivers and harbours. We think they would deter an enemy from attempting to enter, as we think they could not escape destruction either from the ram or the inflammables. If these fire-ships were generally made use of, it would be more than useless to build any more wooden ships of war; it would be a complete waste of money, time, labour, and materials."

The most recent improvements in arms have been adopted, says the *Times* correspondent, by the Prussian Government. The needle gun with which the army is furnished is known in England as the rival of the Enfield, and many consider that it is less liable to get out of order. The merits of the two systems have not yet had a sufficient trial to enable a final judgment to be formed. The artillery already possesses 72 rifled 12-pounders of remarkable lightness. They are of cast-steel, and breech-loaders. In the experiments which have been made the guns were found uninjured after firing 2,000 rounds. Their manufacture is being pushed on with vigour, and they are turned out at the rate of one gun in two days. It is intended that there shall be in each field battery a proportion of unrifled 12-pounders, as the new guns have not been found adapted for firing grape. They have no such destructive missile as the Armstrong shell is described to be. This is the practical way in which Prussia is imitating the example of disarmament.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement :—

STEAM ENGINES, &c., 2952, 2962.

BOILERS AND THEIR FURNACES, 2922, 2955, 2962.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2919, 2948, 2950, 2963, 2970.

SHIPS AND BOATS, including their fittings, 2908, 2914, 2928.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2925, 2964, 2977.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals. *None.*

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2910, 2912, 2915, 2917, 2923, 2932, 2933, 2934, 2941, 2942, 2945, 2946, 2969, 2972, 2974, 2976.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 2924.

LIGHTING, HEATING, AND VENTILATING, 2911, 2949, 2955, 2960, 2975.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2927, 2931, 2954, 2965, 2971.

METALS, including apparatus for their manufacture, 2921, 2935.

CHEMISTRY AND PHOTOGRAPHY, 2961.

ELECTRICAL APPARATUS, 2937.

WARFARE, 2938.

LETTER PRESS PRINTING &c. *None.*

MISCELLANEOUS, 2907, 2909, 2912, 2913, 2916, 2918, 2920, 2926, 2929, 2930, 2936, 2937, 2939, 2943, 2944, 2947, 2951, 2952, 2953, 2956, 2957, 2958, 2959, 2966, 2967, 2968, 2973.

2907. T. S. WOODCOCK. "An improved index or book and paper marker." (A communication.) Dated Dec. 20, 1858.

Here the clasp is of any convenient size, and made of one piece of metal with the angle between its points for receiving the leaf while the clasp is applied in a vertical position or nearly so, and opening to receive the leaf as it is pressed against its edge, and firmly grasping the leaf. *Patent completed.*

2908. S. HUNTER. "Improvements in the construction of anchors." Dated Dec. 20, 1858.

This relates to the arms and palms of anchors, and consists in enclosing the palm at the end of the arm, and making the arm open up to the point of junction with the shank, for which purpose the arm is divided into two parts, whereby the earth in front of the palm or fluke is not crushed or divided by the arm during the dragging of the anchor, but passes through the arm and over the upper edge of the palm in a comparatively compact and solid state, thereby greatly increasing the hold of the anchor by creating a more perfect downward pressure. *Patent completed.*

2909. R. MACLEHOUSE. "Improvements in stereoscopes." Dated Dec. 20, 1858.

This apparatus is in the form of a deep rectangular box fitted at one end near the top with the usual stereoscopic glasses. In the line of sight and between the glasses and the extreme back of the box or case, there is placed an open drum or roller having four or other convenient number of sides. This open drum is arranged to work upon a horizontal spindle to which is attached a projecting handle for turning it by. Behind this drum and in the end of the case there is a hinged door folding downwards, and fitted with a mirror for throwing light into the interior of the case. The pictures are disposed in the chain form over the drum, and so arranged that one end of the chain can fall down into the bottom of the case at the front, and the other at the back portion of the case. With this arrangement as the drum is turned, the pictures are successively drawn up from the back section of the bottom of the case, passed over the faces of the drum on the vertical side of which for the time being they are successively displaced, and then passed down in a zig-zag or regularly folded pile in the bottom of the front portion of the case. The open form of picture drums with the door behind admit of transparencies being viewed in this apparatus. *Patent abandoned.*

2910. J. RONALD. "An improved machine for the direct spinning of hemp, flax, and other like fibrous materials." Dated Dec. 20, 1858.

This machine is constructed of a horizontal endless band or chain, or by preference a pair of horizontal endless bands or chains placed one above another, and on which are mounted a number of gill teeth, the upper and lower teeth of which intersect each other. These endless chains are stretched between two pairs of drawing rolls and work upon pullies at each end. The machine is so arranged that the gill teeth travel a little faster than the periphery of the first pair of drawing rolls, and the second pair of drawing rolls are driven a little faster than the gill teeth, so that there may always be a drawing action on the fibres during their passage through the machine. *Patent completed.*

2911. A. V. NEWTON. "An improvement in lanterns." (A communication.) Dated Dec. 20, 1858.

The object here is to obtain by simple means a combination of reflecting surfaces with or without a lens that will project the rays of light from a lamp into space in a concentrated form, and in parallel lines. The invention consists mainly in the employment of a peculiar arrangement of conical and convex reflector, which form a chamber for the reception of the lamp, and also effects the object above alluded to. *Patent abandoned.*

2912. F. WINTER. "Improvements in the preparation and application of varnishes for waterproofing paper, linen, and textile fabrics, and coating the same with metallic foils." Dated Dec. 21, 1858.

This varnish may be composed of shell-lac, benzoin, and Venice turpentine dissolved in spirits of wine and wood naphtha. Other combinations are included. *Patent abandoned.*

2913. R. M. LIVINGSTON. "An improved self-detaching safety hook or coupling." Dated Dec. 21, 1858.

Instantly on the suspended boat or other weight coming into contact with water or otherwise, and the small chain being disengaged from one of the lever ends, their weighted ends will cause the lower or hooked ends to open. *Patent abandoned.*

2914. W. E. DANDO. "Improvements in apparatus for lowering boats from ships or vessels, and also for raising the same as required." Dated Dec. 21, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2915. J. H. BOLTON and C. GARFORTH. "Certain improvements in drying yarns or fabrics, and in the apparatus connected therewith." Dated Dec. 21, 1858.

The sizeing vat or vessel is furnished with a series of rollers, so arranged that the yarn or fabric may pass over a sufficient number of them, and remain in the size until saturated. It then passes out of the vat between a pair of squeezing or pressing rollers, and becomes partially dried; it is then again passed through the size, and finally between pressing and delivery rollers into a chamber containing near its base a number of vertical arched or bent plates arranged in pairs and forming chambers, and having a series of rollers, so arranged that the yarn or fabric may first pass under or between or in the interior of these arched plates or chambers to be partially dried, and thence along the outside of the plates and over rollers at the top of the outer vertical chamber or room in which all are enclosed where the drying is completed; the yarn passes out of this chamber in a dry and finished state, such chamber plates being heated by steam. *Patent abandoned.*

2916. A. S. BELIARD. "An improved machine for pumicing felts, tissues, and skins." Dated Dec. 21, 1858.

Here the felt is submitted to what may be called a grinding operation by a small mill or grindstone of pumice stone, which is caused to revolve by mechanical means, and is pressed by hand upon other felt. *Patent completed.*

2917. W. S. YATES. "Machinery or apparatus for dragging bristles and drawing hair and vegetable fibre." Dated Dec. 21, 1858.

The inventor employs gill combs and presses between which the bristles, hair, or fibre is placed and held to be operated on, and nippers or jaws capable of closing and opening by the action of tappets or cams, and also having a receding and advancing or reciprocating motion given thereto, so as to advance and take hold of the projecting ends of bristles, hair, or fibre and draw them out from the rest, and which by the opening of the said nippers when out, are deposited in a receptacle. *Patent completed.*

2918. N. DAWSON. "Improvements in order books." Dated Dec. 21, 1858.

This consists in binding up a number of leaves, every alternate one of which is perforated so that it may be readily torn out of the book while the others remain in the book. While taking orders on these perforated leaves a piece of carbonized paper is placed between it and the next leaf, so that an exact counterpart of the order will be obtained. *Patent abandoned.*

2919. W. MAINWARING. "Improvements in brakes for common road vehicles." Dated Dec. 21, 1858.

This relates to brakes for two-wheeled vehicles to relieve the horses attached thereto when going down hill. On the axletree is attached a rigid pendant arm or arms the lower part of which supports the fulcrum of a long lever the fore-end of which carries a skid or brake surface which when lowered rubs against the ground; this end of the lever projects forward in front of the wheels while the back and free end by which the brake is actuated projects behind the cart, &c. so that the driver may readily apply it. This end of the lever is furnished with an arc and stop pin by which to fix the lever in the different positions desired. *Patent abandoned.*

2920. R. CLEGG, F. ANGERSTEIN, and G. FERRY. "Improved mechanism for imparting reciprocating motion to machinery, and more especially pumps." Dated Dec. 22, 1858.

The inventors propose to so construct a cam, as that about three-fourths of its entire revolution shall be effectively employed for lifting, and the other fourth for the descent of the bucket; or instead of lifting and descending only once during each revolution of the said cam, the same may be made to lift and descend twice in each entire revolution thereof, or more times if desired according to the size of the cams. *Patent completed.*

2921. R. MUSHET. "An improvement or improvements in the manufacture of cast steel." Dated Dec. 22, 1858.

This consists in manufacturing cast-steel by melting together, or combining when melted, the following materials, that is to say, broken or crusted or granulated cast-iron, whether cast-iron, whether pig-iron, or refined metal, deoxydized iron ore or oxide of iron, and a metallic compound consisting of or containing iron carbon and manganese. The said materials are melted in melting pots or crucibles heated in furnaces of the kind ordinarily employed for melting steel. *Patent completed.*

2922. G. SHARP and W. ELDER. "Improvements in furnaces and steam-boilers." Dated Dec. 22, 1858.

The inventors supply fuel to the furnace at the speed and time required by a screw placed outside of a hollow barrel or cylinder through the interior of which the necessary air passes to the furnace. The air enters through a nozzle or other suitable arrangement, and the fuel through a hole or other contrivance. Upon the exterior of the barrel are placed feathers or arms for spreading the coal and forcing the air into the interior of the furnace. *Patent abandoned.*

2923. J. NICHOLSON and D. CROSSLEY. "Improvements in jacquard machinery or apparatus employed in weaving." Dated Dec. 22, 1858.

The object here is the weaving of all kinds of double, triple, and two-faced or reversible cloths plain or twilled, by hand or power without the use of heddles, gear, moveable harness boards, or having to stamp the ground on the pattern cards, by jacquard machinery or apparatus so constructed and arranged that it can be operated by a single treadle on the treading tappet of the loom. The inventors employ lifting bars which receive reciprocating motion from the treadle or treading tappet by a lever and connecting rod, also a series of grifes or lifting boards with knotted tabby bands for working both the figure and the ground, which are raised by hooked rods hinged so as to be capable of connecting the boards with the lifting bars at the proper time required, and which is indicated by cams suitably arranged on a shaft or shafts which receive intermittent motion from the motion of the lifting bars. The pattern cylinders receive intermittent motion from the lifting apparatus at the first, second, or third lift of the machine, according to the kind of cloths required to be made, and it is so arranged that it may be turned without moving the loom. *Patent abandoned.*

2924. M. RENNEY. "Improvements in bridges." Dated Dec. 22, 1858.

This relates to bridges usually designated sliding or rolling bridges, which are substituted for swing or swivel bridges, and consists in so constructing a rolling bridge that it shall be perfectly balanced and require but little power to open and close it, and that whilst it is closed, and in use, it is perfectly secure, and the road and approaches are made as it were continuous and unbroken, and when opened or withdrawn the tail or balance end is drawn over the ground line or approach on the balance or withdrawing side, and without injury thereto. The travelling of the bridge in and out may be effected by a rack or racks or otherwise. *Patent completed.*

2925. W. SPENCE. "Improvements in granaries or apparatus for preserving grain." (A communication.) Dated Dec. 22, 1858.

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This consists of a strong chest composed of wood or other material adapted to give it strength supported on pillars or standards and strengthened by cross tie pieces bound together by clamps, being also kept from yielding to the pressure in an outward direction by longitudinal and lateral stretchers. The bottom of the said chest terminates in a funnel or hopper, and at its extremity is fitted a pipe or conduit, furnished with a valve or regulator, which is closed by a padlock when the apparatus is at rest. This pipe or conduit, which serves equally for putting grain into sacks, leads to a sieve of ordinary form and furnished with a handle or means of turning it on each side. To the sieve is connected an inclined board or channel receiving a jerking kind of movement from the sieve, and which conducts the grain from the latter to a receptacle either under or above ground, which receptacle is closed by a door. Into this receptacle an endless bucket chain dips, being passed over a pulley at the lower part of the receptacle, and over another mounted at the upper part of the apparatus. On the axle of the former pulley is another of larger diameter, which by means of an endless strap or band communicates the motion of the chain to the sieve when the apparatus is driven by mechanical power, but when manual labour is employed motion is communicated from the sieve to the chain. The chain receives its motion from the prime mover through a driving pulley. At the upper part of the apparatus is a receptacle for the grain as it is carried up and deposited by the working of the chain, such receptacle communicating with the apparatus through a grating to prevent mice, &c., from passing into the same. Access is afforded to the upper part of the apparatus by a staircase or otherwise, and there is a railing to prevent accidents. There is also an indicator consisting of a ball suspended by a cord or chain, to which is also connected a kind of parachute with moveable wings. As the grain has become ventilated or winnowed the ball descends to obstruct the passage of it to the sieve, and when the contents of the granary or apparatus have been operated upon, the outlet is closed, and the ball is drawn up again, the wings of the parachute collapsing as it passes through the mass of grain. There is also a graduated index intended to show the quantity of grain which the granary or apparatus contains. *Patent completed.*

2926. E. T. Dunn. "Improved fabrics suitable for the covering of floors, walls, and other like purposes." Dated Dec. 22, 1858.

This invention was described at page 62, No. 4, of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

2927. E. GREEN. "Improvements in tables." Dated Dec. 22, 1858.

This consists in forming tables with a central revolving disc, which is fixed within or placed upon the centre of a table. Or in constructing tables with two or more discs, each having a separate motion to enable them to move in the same or in a reverse direction. It also consists in fitting suitable gear to the tables, so that the discs on one or more of them may be rotated by turning a handle or treadle. *Patent abandoned.*

2928. M. SHULDHAM. "Improvements in ships and vessels, and in working parts of their gear and rigging." Dated Dec. 22, 1858.

This consists in methods of running in or hoisting up a ship's bowsprit, with its jib-boom and flying-jib-boom, so as to enable a ship, constructed as a steam ram, to carry sufficient head-sails, and notwithstanding to be in a fit state to perform the duty of a steam ram. *Patent abandoned.*

2929. F. RANSOME. "Improvements in the manufacture of grinding and rubbing surfaces." Dated Dec. 22, 1858.

This consists in combining ground glass or emery with soluble or easily fusible silicates with or without other matters. *Patent completed.*

2930. A. PRINCE. "Improvements in ornamenting and illuminating surfaces of glass." Dated Dec. 22, 1858.

This consists in the application of lace or flower pattern glass having clear plain centres or spaces, such centres or spaces being encircled or delineated by ornamental plain or coloured bordering, so as to form an interval frame pattern, and in and upon such colour centres or spaces chromolithograph or other impressions prints or paintings are transferred, attached, or painted, and then coated and covered with suitable crystal cements and varnishes as a protection against damage from atmospheric influence or moisture. *Patent completed.*

2931. J. J. WELCH. "Improvements in the manufacture of neckties, scarfs, or cravats." Dated Dec. 22, 1858.

This consists in letting in, inserting, or attaching ornamental ends or tips to the ends of neckties, scarfs, or cravats, and such ornamental ends may be so attached by the aid of the sewing machine or by hand work. *Patent abandoned.*

2932. D. LICHTENSTADT. "Converting a certain vegetable substance into fibrous material for the manufacture of textile and other fabrics." Dated Dec. 23, 1858.

This consists in utilizing the sugar cane deprived of its sugar by reducing that vegetable substance to fibrous material which may be spun, woven, and otherwise treated so as to produce textile and other fabrics. *Patent abandoned.*

2933. J. RONALD. "Improvements in, and machinery for, the manufacture of hard-topped and soft-laid twine, mill banding, strands for ropes and other purposes, and cordage generally from hemp, flax, cotton, and other like fibrous material." Dated Dec. 23, 1858.

This consists of a number of revolving spindles or frames, each of which carries one or more bobbins on which the yarn is wound. The inventor gives an independent rotary motion to each of these spindles or frames by which any required amount of twist can be put into each yarn as it is drawn off the bobbin or bobbins, which is effected by a series of drawing rollers. The yarns required to form the twine or cord are conducted to sets of drawing rollers through draw-plates or other guides, and after the yarns have passed through several sets of these drawing rollers the hard yarns are then carried vertically down to a flyer by which they are laid, and as the cord is formed it is taken up by the bobbins on the flyer spindles. To spin twine, &c., direct from fibres of hemp, flax, manilla, &c., the inventor gives a rotary motion to the cams containing the slivers by mounting them on or in suitably formed revolving frames fitted with drawing heads. The twist being put into the sliver, and the yarn formed by the revolving drawing head, is carried forward by a series of the drawing rollers as before described, when the yarns are laid by flyers, and the strands as formed are taken up on bobbins on the flyer spindles. To form laid rope or cordage all that is required is to supply the bobbins with strands in place of yarn. *Patent completed.*

2934. S. BIRD. "Improvements in spinning, and in the manufacture of cop bottoms or cop tubes." Dated Dec. 23, 1858.

Here, to prevent waste after the cops are taken off the spindles the inventor applies gum, starch, paste, or varnish, or mixture of chalk, whiting, or flour, either to the spindles or to the threads by a brush or sponge so that when the spinning commences the threads shall be lapped to any desired thickness on to the sticking or thickening substance, which latter becomes hard before the cop is completed, so that the cop can be taken off without injuring the bottom, and which also prevents any unravelling or waste from picking. There are modifications included. *Patent abandoned.*

2935. J. BROOM. "Improvements in the manufacture of steel." Dated Dec. 23, 1858.

Here pig iron is deposited in its raw unheated state in the furnace, and it is worked and puddled in the usual way except that the furnace is kept as full as possible of pure white flame, the atmospheric air being excluded from it as much as possible. The mass of iron is also kept surrounded with cinder as a protective covering to keep off the contact of air with the metal. Sal ammoniac or salt may be added to improve the protective covering of cinders. The iron so puddled when tilted, hammered, or rolled becomes good steel. *Patent abandoned.*

2936. J. WHITELAW. "Improvements in sewerage and drainage apparatus. Dated Dec. 23, 1858.

In arranging receiving and descharging apparatus according to this invention the trap or sewer and drain chamber is so contrived that the fluid matters discharged from the road or street are caused to flow into the receiver through a hinged grating into the body of the trap-chamber. From this part the matters flow off beneath a hanging diaphragm, thence passing off at the other side over the top of a second diaphragm or division, and thence down to the main sewer or descharge duct. This diaphragm portion of the chamber is covered by a perforated plate of metal on which is disposed a layer of charcoal, lime, or gypsum, which layer is again covered in by an adjustable top plate level with the surface of the road. The roof-water from the houses is conducted into the chamber at the part between the two diaphragms so as to discharge the water in the same way as the street-surface water. Another branch also from the water pipe leads into the space containing the deodorizing matter. This branch serves to allow of the free escape of the gases from the chamber after passing through the deodorizing matter so as to pass right up the water-conducting pipes to the top of the house. In this way so long as much rain water is discharged into the trap chamber the gases are carried directly off down the drains, but when the water pipes are empty the deodorized gases are passed off high into the air without doing injury. *Patent completed.*

2937. A. BARCLAY. "Improvements in obtaining and distributing or applying electricity and magnetism, and obtaining motive power therefrom." Dated Dec. 23, 1858.

This consists in a means of obtaining electricity from the earth in great quantity, and in distributing it and applying it either in quantity or intensity to practical use. According to one modification the receiving end of a conducting wire or series of wires is connected to a vertical or other line of parallel wires laid together, and which line forms the centre of a series of transverse or radial aries. These wires are so attached to the main central line that the arrangement resembles a "bottle brush," presenting a vast number of radial points for the collection and reception of electricity. This collector is sunk in the earth, so that each wire point takes up a portion of electricity and the points as a whole convey the electricity to the main central line of wire, and thence to the line-wire or conductor, which may be a telegraph cable or a conductor to an electric power machine. Or the apparatus may be immersed in a well containing a solution of sulphate of copper. Instead of radial wires metal discs may be used. In the case of a telegraph cable one of these arrangements is fitted up at each end, one being the collector and the other the distributer of the electricity. The invention also relates to an apparatus operating generally upon the galvanometrical principle, and capable of use for telegraphic purposes and for obtaining motive power. The details of this part of the invention are voluminous. *Patent completed.*

2938. J. MAUDSLAY. "Improvements in the construction of ordnance and projectiles to be used therewith." Dated Dec. 23, 1858.

This consists in the construction of ordnance and projectiles in such manner as to combine means of loading at the breech with a rifled bore and corresponding projectile. The breech chamber which is to contain the charge of powder is to be formed by preference of wrought-iron or steel, while the remainder of the gun is to be formed of cast metal. The shot, shell, &c., is to have formed on it a key or keys, feather or feathers for the greater part of its length, and the gun has formed in it a corresponding groove into which the key or feather on the projectile takes, and along which it moves. The thickness of the gun is increased about the groove in order to provide for the weakening effect which the formation of the groove would otherwise produce. The shifting breech is to have a lateral motion imparted to it bodily, and sufficient in extent to permit of the projectile being placed in its proper position in the gun. The breech is then brought back to its place by any convenient means, and there secured by a screw or otherwise. *Patent abandoned.*

2939. J. T. P. NEWBON, T. SMITH, and J. BROWN. "Improvements in machinery or apparatus for raising and lowering, or otherwise moving heavy weights." Dated Dec. 24, 1858.

This relates, 1, to the combination of grooved drums, pulleys, or barrels as described with worm and wheel gearing. 2. To a novel contrivance for compressing the links of chains after they have been hauled in. The invention is not described apart from the drawings. *Patent completed.*

2940. W. ELERS and L. FINK. "The filtration of dissolved sugar and other liquids." Dated Dec. 24, 1858.

This consists of a vessel with two bottoms, the upper one perforated with holes to which is attached the bag or filter. The two bottoms are placed apart from each other, thereby forming a chamber into which the liquor is introduced by a pipe from a higher level, which liquor rises through the holes into the bag or filter, and when filtered escapes by a pipe above the chamber between the two bottoms while the refuse remains in the chamber, or may fall into another chamber placed below it, from whence through an aperture the refuse can be removed and the chamber cleansed without disturbing the bag or filter. *Patent abandoned.*

2941. J. W. CHILD. "Improvements in the manufacture of fabrics adapted to be used for curtains, coverings of furniture, tables, covers, and such like uses." Dated Dec. 24, 1858.

The object here is to produce fabrics of a character now generally called "rep," or ribbed, and adapted to be used for curtains, coverings for furniture, &c., with pattern in various forms alike on each surface, combined with a ground work composed of ribs of

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equal or unequal thickness, and such pattern or figure may be obtained on each side of the fabric from either the warp or the weft. When the pattern is to be obtained from the warp, such warp will be operated by the Jacquard, or otherwise, to obtain a like floating or satin pattern of the figures therefrom; and at the same time on each surface of the fabric, and to produce the different sizes of ribs, weft-threads of different thicknesses or quantities are employed. When the pattern is to be obtained from the weft, the operations will be conducted so as to obtain like floating of weft threads in place of warp on each surface of the fabric. *Patent completed.*

2942. J. W. Child. "Improvements in dyeing wool and other fibres." Dated Dec. 24, 1858.

This consists in dyeing wool, &c., when formed into a connected sliver by drawing such fibre in a continuous line in a distended state through the dye liquid, and thence to suitable washing and drying means, from which it is formed into balls or other forms. *Patent completed.*

2943. L. D. Owen. "Improvements in manufacturing horse-shoe nails." (A communication.) Dated Dec. 24, 1858.

This consists of apparatus having suitable framework, with a shaft of proper strength and material hung thereon. On this shaft is an excentric, which may be made self-adjusting, and to such excentric the inventor attaches a chilled roller; on each revolution of the shaft the roller is made to strike the nail, rod, or iron a drawing or sliding blow from the head towards the point. The nail-rod having been passed in a red hot state between the two dies, and before the roller has made another revolution to give another such blow. One of the dies which is moveable is, by an excentric or cam, caused to strike such nail sideways or horizontally, the other die which is fixed acting as a block or anvil. The shaft may be arranged to move forwards and backwards or to be stationary. The nail-rod is made to pass through a holder which has a kind of jigger motion to prevent scales forming on the nail-rod, and the inventor gauges the required length of nail-rod by a spring connected with such holder; the holder and nail-rod are then drawn back by cams, and when the nail is formed it is cut off and finished at each end if necessary. *Patent abandoned.*

2944. E. Fellows. "An improved vent peg." Dated Dec. 24, 1858.

This consists of a metal peg or stopper made of a taper form with a screw upon it. *Patent completed.*

2945. D. Edleston. "Improvements in preparing and finishing textile fabrics, and in the means or apparatus employed therein." Dated Dec. 24, 1858.

This consists, 1, in folding the fabrics in the wet state, whereby a better "rigg" in the finish is obtained. 2, in crabbing byaseries of cylinders arranged and constructed so as to have an increase of surface speed either by increase of diameters respectively, or in the relative times of rotation, such cylinders being immersed in hot water. 3 in the adaptation of such cylinders to the drying of textile fabrics by having them made hollow, drawing away the hot water and introducing steam to the interior thereof. 4 in combining the folding or rigging with the drying in one process by passing the fabric at its middle over the edge of a pulley or curved plate in a suitable position, by which the folding is effected and the fabric is then passed to the drying cylinder in the folded state. *Patent completed.*

2946. J. Railton and S. Lang. "Improvements in looms. Dated Dec. 24, 1858.

This relates to looms in which a double "dobby" is used for working the healds, and the invention consists in the application of a single slide to work the double "dobby," which slide is moved to and fro horizontally by a toothed wheel or pinion gearing into a rack fixed to or forming part of the slide. The pattern cylinders are turned round by catches jointed to a lever put in motion by the slide. The pegs on the pattern cylinders, or on the lattices passing over them, act on wires or tumblers connected to the slide, and these wires or tumblers are hooked to catch hold of knives or hooked rods to which the healds are connected by cranks or cords passing over pulleys. *Patent completed.*

2947. E. Humphrys. "Improvements in brazing metal tubes in tube-plates and other metal surfaces to each other." Dated Dec. 24, 1858.

This consists in employing fluid metal in order to apply the requisite heat to melt the solder. *Patent abandoned.*

2948. A. Smith. "Improvements in gigs, dog-carts, and other vehicles." Dated Dec. 24, 1858.

This consists in the application of a spring resting upon a lever, affixed in or to the frame work of the front part of the vehicle. The lever is connected with a plain or other wheel having two circumferences inserted in the nave of one of the wheels of the vehicle, and the draught regulated thereupon by the action of a self-acting and self-regulating lever moving either backwards or forwards, according to the weight affecting the same. Motion being given to a pair of wheels connected with a self-acting and self-regulating screw attached to the body of any such vehicle, the draught on such vehicle resting upon three wheels on either side, inserted in the frame work of the vehicle, will be regulated and adjusted, and the body or framework may be drawn by the screw either backward or forward. *Patent abandoned.*

2949. J. Little. "Improvements in lamps." Dated Dec. 24, 1858.

This consists of a central oil reservoir suspended from a rod attached to the ceiling or carried by a pedestal. From this central reservoir branches extend laterally for carrying the burners. Each branch terminates in a widened upward bend, to act as a chamber for containing the wick as well as to receive the oil in quantity sufficient to saturate the wick from the central reservoir. On the top of this branch chamber, there is screwed a wick-holder of any form with a pinion or other elevator. Upon this wick-holder there is fitted the actual burner, consisting of a top cap-piece perforated at the sides to admit air to pass in to aid combustion. *Patent abandoned.*

2950. J. H. Johnson. "Improvements in the permanent way of railways." (A communication.) Dated Dec. 24, 1858.

This consists in cutting notches or slots in the webs or shanks of the rails at their ends, and in inserting into such notches or slots wrought or cast iron joint-pieces of such a section as to enable them to fit accurately into the slots, and at the same time to fit against the sides or under the head of the rails at the ends thereof. To afford facility for taking up the rails certain of the rails, say every tenth rail, should have the slot made of extra length, so as to admit of the joint piece being slid along such slot, and consequently unlocked from the adjoining rail end, when the unlocked rail may be taken up. At these parts the joint-pieces may be retained in their places when locked by wooden wedge pieces driven behind them into the slot, and secured therein by a pin. *Patent completed.*

2951. R. L. Giandonati. "Improvements in ornamenting leather cloth." Dated Dec. 24, 1858.

This consists in ornamenting leather cloth by printing ornamental designs thereon, either in colours, or in metallic powders, or foil, without any further manipulation or treatment. *Patent abandoned.*

2952. W. B. Johnson. "Improvements in the employment of gas for generating steam, and in engines connected therewith." Dated Dec. 24, 1858.

This consists in certain methods of regulating the combustion of gas accordingly as more or less heat is required to be imparted to the boiler. For this purpose the inventor employs the governor of the engine, and causes it to act upon cocks or other such apparatus, so as to regulate the flow of gas. Also for the like purpose he causes the pressure or the temperature of the steam or water to act similarly to the governor. The invention also relates to the prevention of accidents arising from the water becoming deficient. In such cases he causes the supply of gas to be shut off or diminished by the water falling below a certain level. The invention further consists in the application of a "master light," for regulating the burners after the supply has been shut off and reopened. There is also an arrangement of engines and boilers to be used in conjunction with boilers heated by gas. The boiler is formed as a vertical cylinder of cast iron, with a concave bottom of copper. To the side of this the cylinder is bolted, and the main shaft passes transversely over the boiler, carrying the fly-wheel upon the opposite side of the cylinder. *Patent completed.*

2953. M. A. F. Mennons. "An improved composition for the protection of certain metallic surfaces." (A communication.) Dated Dec. 27, 1858.

This consists in a combination of certain organic and unorganic substances which, introduced into boilers, &c., prevents the deposit or incrustation. The following ingredients are employed in the preparation of 100 lbs. weight of this compound:—Oak bark, 24½ lb.; salts of soda, 31 lb.; wood ash, 15 lb.; soda crystals, 24½ lb.; ground linseed, 4 lb.; graphite, 1 lb. These substances being reduced to powder, and thoroughly incorporated, are laid aside in a dry place. When required for use, a given quantity is reduced to a semi-liquid consistence by hot water, to which is added about 2 lb. per cent. of tallow. The mixture is then passed into the generator in the proportion of about ¼ oz. (avoirdupois) of the powder per hour for each horse power. *Patent completed.*

2954. J. Radley. "An improved cooking apparatus." Dated Dec. 27, 1858.

This apparatus is adapted to the operations of roasting, boiling, baking, stewing, frying, and steaming, and all these operations can be carried on at the same time with one moderate-sized fire, and with little attendance. A modification of the apparatus may be readily adapted to travel on wheels, in order to cook for an army on the march; it carries its own fuel and water, and in this case the rotary motion for the roasting cage may be derived from the wheels. *Patent completed.*

2955. T. Steven and T. Scott. "Improvements in heating apparatus for culinary and warming purposes, and in part applicable to steam boiler and other furnaces." Dated Dec. 27, 1858.

In a cooking range embodying some of these improvements the air is admitted through oblique openings in a door or frame, such openings being formed by using Venetian or oblique bars, fixed or adjustable as regards their positions. The object is to cause the air to enter so as to thoroughly mix with the fuel gases, and lessen the formation of smoke. In making a boiler for a cooking range, or for causing the circulation of hot water in pipes for heating apartments, it is preferred to form the bottom with corrugations. The boiler is formed with flanges, either solid or hollow, so as to constitute water spaces. If the cooking range is of the close fire class an independent flue or pipe is carried from it a sufficient distance up the chimney of the kitchen to obtain the requisite draught, without closing up the throat of the chimney or applying valves to it. The flue pipe has a valve to regulate the draught. When cooking is suspended, the apparatus is converted into an open fire-range by opening the fire-door and cover. The invention also comprises various improvements in stoves of the Register or Leamington class. *Patent completed.*

2956. J. Smethurst. "Certain improvements in metallic pistons." Dated Dec. 27, 1858.

The object here is to render metallic pistons more elastic and easier of adjustment than heretofore. The inventor makes use of two packing rings, the inner circumferences of which are bevilled to fit a wedge ring, which is cut through in one place, or made in two or more parts, and is acted upon by an eccentric spring ring. The spring ring is made of cast-iron, and is cut through at one part. The spring ring must first be turned rather more in diameter than the internal diameter of the wedge ring or segments to give the requisite elasticity. These pistons can be used either with or without adjusting screws to act on the wedge ring or segments. *Patent completed.*

2957. J. Shaw. "A new mechanical combination, called an indefinite fœd movement?" Dated Dec. 27, 1858.

This invention is not described apart from the drawings. *Patent completed.*

2958. W. A. Gilbee. "Improvements in treating fatty bodies and in the apparatus employed therein." (A communication.) Dated Dec. 27, 1858.

This consists, 1, in distilling neutral fat and fat acids at a regular temperature between 660° to 670° Fahrenheit in superheated steam. 2. In the employment in the distillation of neutral fats and fatty acids of an air-pump working with an intermittent motion in connection with the ordinary still and refrigerator for extracting the gases of distillation from the still as soon as formed, and by which a regular temperature between 660° and 670° Fahrenheit is maintained, the loss of the material by the ordinary process in great part avoided, and a good product obtained. *Patent completed.*

2959. J. Macpherson. "Improvements in solidifying the raspings and other waste of horns and hoofs, and in applying the process to the cementing of prepared horns, hoofs, and tortoiseshell." Dated Dec. 27, 1858.

This consists in subjecting the dust, shavings, raspings, &c., of animal horns and hoofs first to the action of moisture and heat, and afterwards to considerable mechanical pressure, whether to solidify the softened waste material, or to cement prepared pieces of horn to each other or to tortoiseshell. *Patent completed.*

2960. J. Davis. "An improved portable self gas-generating lamp. (A communication.) Dated Dec. 27, 1858.

This relates to hydro-carbon vapour-burners, and consists in the use of a heating or vaporising tube and retort charged with asbestos or any analogous material and carbonaceous fluid; ormond oil or other hydro-carbons, passing over the flame of a burner

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supplied with vapour generated within the tube or retort into which the fluid ormond oil or other hydro-carbons are charged by pressure. It also consists in providing the tube and retort so charged with a cover or cup to retain the heat around its upper surface. It also consists in such an arrangement of the several parts that the fluid ormond oil or other hydro-carbons from the reservoir is supplied to the heating parts of the vaporising tube by pressure, and the entire vaporization and burning of its material effected without a residuum. *Patent completed.*

2961. C. M. A. Marion. "An improved box or case for containing and preserving sensitive photographic paper." Dated Dec. 27, 1858.

This consists of a box with a double bottom hermetically sealed, and containing in the one part chloride of calcium, and in the other the paper to be preserved. *Patent completed.*

2962. F. W. Turner. "Improvements in steam-engines, condensers, and steam-boilers, and in promoting combustion in the furnaces of the same." Dated Dec. 27, 1858.

This consists 1. in increasing the condensing power of ordinary jet condensers, and in keeping a portion of the water which is condensed separate and distinct from the water which condenses, by inserting a cluster of brass or other metal tubes fixed vertically into a plate at their lower ends, and at their upper ends into the bottom of a shallow vessel, which vessel is supported by the tubes and is free to move vertically to the extent the tubes will expand on the application of heat. 2. In the employment and a mode of employing compressed air for condensing steam in steam-engines; also in the mode of compressing and superheating air to be used in a minutely divided shape in the fire-boxes of steam-boilers above and below the fuel, or in combustion chambers, or chambers in connection with fire-boxes or flue-tubes. 3. In a peculiar construction of combined steam cylinders to facilitate the working of high-pressure steam expansively, and to prevent the condensation or diminution of temperature of such steam while working or expanding in the cylinders by enveloping the cylinders and superheated steam in steam-tight cases; which steam in its passage to the cylinder cases passes through certain heating apparatus, and thus conveys a greater quantity of heat than is due to its pressure to the cylinders. 4. In the application of steam-tight cases on certain portions of the external surface of steam-boilers for distilling pure from impure water. 5. In certain improvements in packing for pistons. *Patent completed.*

2963. H. Lowe, W. Trueman, and J. L. Pitts. "A new or improved axle for carriages." Dated Dec. 27, 1858.

On an axle in which a saddle piece engaging with or sliding upon a neck near the end of the axle arm, constitutes the bearing against which the small end of the axle-box works. *Patent completed.*

2964. R. Hornsby, jun. "Improvements in ploughing and tilling land by steam power, and in apparatus employed therein." Dated Dec. 27, 1858.

In adapting agricultural steam-engines to give motion to ploughs, &c., the inventor mounts the winding drum or drums in such a position that they can be driven from the crank shaft of the engine by straight spur wheels or straight gearing without the intervention of bevilled wheels, chains, or straps, and for this purpose he in some cases mounts such drums so as to run on tubular axes, through which the axles of the bearing wheels of the engine pass excentrically to the tubular axes. Or the drums may be mounted on studs, or axes fixed to the sides of the engine, and in either cases he arranges clutch boxes or similar contrivances, through which the power of the engine is communicated to the drums, immediately on the drums, or else on parts running at the same low speed as the drums, in place of to parts running at the high speed of the engine. *Patent completed.*

2965. B. Browne. "Certain improvements in the manufacture of boots and shoes, or other coverings for the feet, and in the mode or method of uniting the same or parts thereof." (A communication.) Dated Dec. 28, 1858.

This relates chiefly to "Blucher" boots, and consists, 1. in making the lower and outer portion of the quarter of the upper longer than the top or middle part at the point or place of junction, so that it is made to overlap the piece in which the string is passed and secured to the front. 2. In uniting to the front or upper a strip of leather, canvas, &c., and which in some cases is made to form a side lining, and which is proposed to be continued so long and around the upper and waterproofed. The chief advantage of this strip is, that the prime part of which the front or upper is composed can be made smaller in size, as the piece serves as a portion to be taken hold of so as to draw the upper well on to the inner sole. 3. In a mode of connecting metal tips to boots and shoes. *Patent completed.*

2966. J. Sinclair. "Improvements in pistons." Dated Dec. 28, 1858.

This comprehends improvements in various parts of the piston, and modifications thereof. The invention is not described apart from the drawings. *Patent completed.*

2967. T. Warren. "Improvements in the manufacture of glass bottles." Dated Dec. 28, 1858.

Here the bottle having been blown and saucered in the ordinary way is wetted off upon a pontil, which is fitted into a case or socket and is made to revolve by a simple arrangement of gearing whilst the mouth is being formed. The mouth of the bottle is shaped by a pair of sheers carried by a stand and placed in a suitable position near the apparatus carrying the pontil, the sheers being closed upon the hot glass whilst the bottle is revolving, and thereby imparting the proper shape and finish to the mouth. The added metal for forming the thickened lip or ring of the mouth may be applied in the ordinary way, but it is preferred to have a small supplemental furnace at the side to contain the metal for lips or rings, and to take therefrom the requisite quantity by dipping in the bottle. For "wetting off" the water is made to issue upwards under a slight pressure from a simi-circular mouth, and the bottle is laid so as to expose its neck to the issuing water. *Patent abandoned.*

2968. A. Lyons. "Improvements in travelling bags." Dated Dec. 28, 1858.

This consists in uniting two bags or similar receptacles side by side through the medium of a double-framed mouth or opening, the said frame being formed of three parallel bars secured at the ends by link or spring movements which admit of the bag, when attached thereto by sewing or otherwise, being opened or closed, as also one of the bags to be turned up and placed at right angles with the other by which a cushion to the seat and back of the conveyance is formed. *Patent abandoned.*

2969. J. Leck. "Improvements in drying textile fabrics and materials." Dated Dec. 28, 1858.

Here the fabric to be dried is first placed over a steam-can or heated cylinder; it is then directed clear of the cylinder or can and passed up and over a roller of triangular section. In this way the piece is conveyed through the air and agitated in it prior to descending and passing over a second steam-can or cylinder. *Patent completed.*

2970. C. Fay. "Improvements in railway carriages and brakes." Dated Dec. 28, 1858.

This relates to a former patent, and consists, 1, in a peculiar self-acting stop motion for regulating the distance by which the brake blocks are removed clear off the wheels by the guard in unbraking the train. 2. In a self-acting and self-adjusting reversing apparatus, whereby the brakes may be used from either end of the train without the use of any extra hangers or blocks. 3. In a worm and straight rack motion applied to a carriage or waggon brakes for acting the same. *Patent abandoned.*

2971. J. H. Johnson. "Improvements in the manufacture of boots and shoes or other coverings for the feet." (A communication.) Dated Dec. 28, 1858.

This relates, 1, to a mode of cutting or punching out the soles, so as to produce bevilled edges at a single operation. 2. To modes and means of bevilling, reducing, skiving, shaping, buffing, and splitting the various parts of boots and shoes. The invention is not described apart from the drawings. *Patent completed.*

2972. W. Haworth and W. Barker. "Improvements in the top clearers of machines for spinning." Dated Dec. 29, 1858.

This consists in making the top clearers conical, so that when they are turned round by the friction of the top rollers, there will be a rubbing action between the surfaces, which causes the flyings to accumulate evenly over the surface of the top clearers, whereas when the clearers are cylindrical the flyings sometimes collect in lumps, which falling in the yarn causes it to break. *Patent completed.*

2973. T. Welton. "Improvements in giving or obtaining publicity, and of advertising either by day or by night." Dated Dec. 29, 1858.

Here the inventor allows artificial light either to pass through certain openings in an opaque or semi-opaque ground, such openings forming the desired letters, designs, or devices; or he uses opaque letters upon a transparent or semi-transparent ground. *Patent abandoned.*

2974. E. W. Carter and J. D. Abrams. "Certain improvements in sewing machines." Dated Dec. 29, 1858.

This consists, 1, in the use of two springs, one at each side of the shuttle for slightly confining the shuttle in its race. 2. In the use of a spring or springs within the shuttle carriage or arm to keep the shuttle in contact with the race or guide, and also in the use of two or more springs on the under surface of the covers or plates covering the race to press upon the top of the shuttle for preventing the vibrations of, and steadying the shuttle in its race. 3. In the use of a circular curved race or guide of the shuttle for causing the shuttle to move in a circular direction. *Patent abandoned.*

2975. W. Taylor and W. D. Grimshaw. "Regulating the admission of natural atmospheric air and eduction of rarefied air or gases from hothouses or any other place or premises, and for supporting a required temperature." Dated Dec. 29, 1858.

The patentee describes a self-acting ventilator or damper regulator for regulating the admission of natural atmospheric air and eduction of rarefied air or gases from hothouses, &c., and for supporting a required temperature, the said apparatus is actuated by pressure of steam, water, gas, or any other fluid, or by the temperature of the atmosphere; it is also applicable to other purposes. *Patent completed.*

2976. R. D. Kay. "An improved chemical means of applying or fixing on woven or felted fabrics certain colouring matters produced from tar." Dated Dec. 29, 1858.

This consists of means of applying on printing fabrics colouring matter produced from tar. Some of the matters used have been called harmuline, indisine, and tuchsine. The method of fixing the said colouring matters consists in the use of them in solution in combination with albumen, caseine, protein, lachtarine, &c., and as these matters are not all soluble in water the inventor dissolves them in oils, or oils and alkalies, or tartaric or other vegetable acids, or a mixture of two or more of these substances. He applies the matter by blocks, rollers, &c., and subjects the fabrics so printed (after drying) to the action of steam. *Patent completed.*

2977. S. Pickford. "Improvements in the preparation and manufacture of manure." Dated Dec. 29, 1858.

This consists, first, in treating Sombrero Island phosphate guano, bone, caroh, or mineral phosphate with sulphuric, hydrochloric, or nitric acid, in a certain manner, by which means he obtains soluble salts, with the whole of the phosphoric acid present, or nearly so. Second, in combining the said phosphoric salts with nitrogenized substances, alkaline salts and earthy bases in such proportions as varied circumstances may require. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 28, 1859.

1538. G. Dawes and C. J. Carr. Certain improvements in atmospheric and vacuum hammers and stamps, part of which improvements is also applicable to steam and other engines.

Dated June 30, 1859.

1560. J. Lawson. Certain improvements in machinery for roving, twisting, and spinning flax, cotton, wool, and other fibrous substances.

Dated July 6, 1859.

1602. J. Luis. An improved mode of manufacture of wheel tires for railway carriages and engines, by means of the therein described apparatus. A communication.

Dated July 8, 1859.

1623. J. Gibbs. Improvements in the manufacture of brushes, brooms, coverings for floors, mats, scrapers, and other scraping and rubbing surfaces.

Dated July 12, 1859.

1652. J. Luis. Improvements in railway car seats and arm chairs. A communication.

1653. C. J. Proal. The application of photographic impressions or pictures upon fabrics or tissues, for rendering such fabrics or tissues applicable to various useful purposes. A communication.

Dated July 19, 1859.

1698. J. Luis. A new system of eccentric socket adapted to axletrees. A communication.

1702. J. C. Riddel. Improvements in stalls, loose-boxes, and enclosures for horses, cows, pigs, or other animals.

Dated July 20, 1859.

1704. T. Curtis and J. Haigh. Improvements in the finishing of cloths.

Dated July 21, 1859.

1711. J. Todd, jun. Improvements in machinery or apparatus for dressing or cleansing and separating grains and seeds.

1712. G. Welch. An improvement or improve-

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ments in the manufacture of frames for mirrors, pictures, and other articles.

1713. I. Robson. Improvements in means or apparatus for drying and cuttling cotton warps after being dyed or sized, or after any other process of wetting, and when quick drying is required.

1715. M. Henry. Improvements in apparatus or machinery for the manufacture of corks and bungs. A communication.

1716. E. J. and S. F. Scott. Improvements in the manufacture of boots and shoes.

1717. H. Healey. Improvements in machinery for destroying flies and other insects on growing crops.

Dated July 22, 1859.

1718. J. Hartley. Improvements in machinery for regulating the velocity of steam and other engines.

1719. J. G. Isham and S. D. Albertson. Improved machine for cutting and shaping bottle and other corks. A communication.

1720. S. A. Bell and J. Black. An improved manufacture of fusee.

1721. W. E. Newton. Improvements in sewing machines. A communication.

Dated July 23, 1859.

1722. J. B. Whitehall and S. Wheatcroft. Improvements in the construction of certain parts of the apparatus or machinery made use of for manufacturing bonnet and cap fronts, rouches, and such like articles of millinery.

1723. H. N. Harrop, jun. Certain improvements in a cigar lighter and fusee box.

1724. J. Broadley. Improvements in means or apparatus used in weaving.

1725. J. Tenwick. Improved steering apparatus for ships.

1726. W. H. Harfield. Improvements in capstans, riding bits, and stoppers for working with chains.

Dated July 25, 1859.

1727. H. Ambler. Improvements in explosive projectiles.

1728. J. Rowland, jun. Improvements in machinery or apparatus for sizeing yarns or threads, which said improvements are also applicable to dressing machines, or other similar apparatus.

1729. G. Davies. Improvements in dyeing yarns, threads, or woven fabrics, of wool, silk, cotton, linen, or other fibrous or filamentous material. A communication.

1730. E. Hunt. Improvements in apparatus for indicating and regulating speed.

1731. W. E. Newton. Improvements in extracting oil from coal, and other substances yielding pyrogenous oils. A communication.

1732. C. F. Vasserot. Preventing and removing incrustations in steam boilers. A communication.

Dated July 26, 1859.

1733. J. King. Improvements in the treatment of materials used in, or resulting from, the distillation of spirits.

1735. J. H. Johnson. Improvements in slide valves for steam-engines. A communication.

Dated July 27, 1859.

1741. E. Winstanley. Improvements in indicators for registering the quantity produced by spinning machinery.

1743. T. Dickins. Improvements in dyeing and discharging warps or other yarns or threads, and woven fabrics of silk, wool, cotton, and other fibrous materials.

1745. C. L. Blum. A mechanical apparatus for smoking and colouring pipes.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(From the London Gazette, Aug. 9, 1859.)

756. R. Baker. Timekeepers.
767. J. C. Evans and P. Soames. Superheating.
771. J. Buckley, O. Greenhalgh, and R. Hutchinson. Printing fabrics.
773. C. F. Vasserot. Diving apparatus. A communication.
781. J. W. Kelly. Gas burners.
801. W. and E. Smith. Regulating.
802. J. Lacy, S. Simpson, and H. Smith. Spinning.
804. R. C. Ross. Cultivating land.
808. D. B. White. Gauge-lead or plummet.
834. T. Williams and J. H. Fuller. Screw stocks and dies.
836. J. Eccles. Bricks, tiles, &c.
840. J. H. Burton. Barrels for fire-arms.
843. C. Russell. Marine engines.
846. E. Morewood. Coating metals.
847. D. Sowden. Jacquard machines.
857. N. Libotte. Cages for drawing coals.
862. W. Owen. Wheels and tyres. Partly a communication.
863. J. Rogers and E. J. Tweed. Coating conducting wires.
871. J. Garrett. Goblets, jugs, &c.
872. J. Rawlings. Boot tree.
873. J. T. Pitman. Fireworks. A communication.
878. M. A. F. Mennons. Articulated joint. A communication.
879. M. A. F. Mennons. Phosphates of lime. A communication.
890. J. Hawkins. Stirrups, bits, &c.
912. P. Aitchison. Taps.
918. M. Castay. Metallic bridges.
933. J. Hughes, W. Williams, and G. Leyshon. Tin and terne plates.
982. W. Parsons. Preparing metal sheets.
1010. T. S. Truss. Pipes.
1028. W. Stevenson. Spinning, doubling, &c.
1038. W. E. Newton. Sewing machines. A communication.
1084. J. Darlington. Zinc retort furnaces.
1120. J. G. Willans. Utilizing peat.
1162. A. V. Newton. Lamp. A communication.
1180. T. P. Bennett. Carding engines.
1297. C. E. Amos. Raising vessels.
1308. J. C. Bent. Gas-meters.
1313. P. Aitchison. Water closets.
1538. G. Dawes and C. J. Carr. Hammers and stamps.
1648. J. Dible and W. H. Graveley. Ventilating and lighting ships.
1668. J. Morgan. Candles.
1724. J. Broadley. Weaving.
1727. H. Ambler. Explosive projectiles.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 5, 1859.

154. J. Fawcett.
218. J. G. Proger and D. Davies.
338. G. F. Chantrell.
346. J. Smith.
350. J. Hosking.
356. J. B. Redman.
361. E. Wilkins.
362. J. S. Joseph.
368. G. Bower.
369. J. E. McConnell.
371. E. Herring.
376. W. A. Covert.
377. R. J. Ellis.
429. R. J. S. Pearce.
456. W. Clark.
468. G. Paul.
505. J. H. G. D. Wagner.
512. C. W. Siemens.
525. A. Martin and A. Chrichton.
618. W. E. Newton.
680. A. Mein.
744. J. H. Johnson.

Sealed August 9, 1859.

386. H. Bruce.
399. T. White and G. Jenkins.
400. J. and J. Bennett.
491. G., G. W., and J. Beljemann.
495. R. Bell.
411. J. Wright.
500. R. Mushet.
501. R. Mushet.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1840. H. W. Wood.
1848. J. Keith.
1854. J. Y. Borland.
1876. T. Whittaker.
1885. J. Cartland.
1913. W. Tranter.
1939. J. Brouard and J. Hubert.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Aug. 6, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d	1859	s d		s d		s d		s d
2936	0 6	3000	0 10	1	0 6	10	0 3	19	0 9½	28	0 6
2991	0 10	3001	0 7	2	0 3	11	0 3	20	0 3	29	0 3
2992	0 10	3002	0 3	3	0 3	12	1 7	21	0 11	30	0 9
2994	0 8	3003	0 10	4	0 9	13	0 3	22	0 7	31	0 3
2995	0 4	3004	0 3	5	0 3	14	0 8	23	0 6	41	0 3
2996	0 10	3005	0 3	6	0 3	15	0 3	24	0 8	45	0 3
2997	1 1	3006	0 7	7	0 10	16	0 3	25	0 6	...	...
2998	0 10	3007	0 6	8	0 3	17	0 10	26	0 6	...	...
2999	1 6	...	...	9	0 5	18	2 4	27	0 10	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

ENGINE, BOILER, AND FORCE PUMP, *Ireland.*—For throwing up a supply of water to the Constabulary Barracks, in the Phœnix Park, Dublin, from a point 88 ft. in level and 2,850 feet in distance below. The engine to be 6-horse high pressure. Tracings and information of the Secretary, Office of Public Works, Dublin. Sketches of engine and proposed arrangements to accompany the tenders up to August 27. E. Hornsby, Secretary.

IRON SUPERSTRUCTURE TOWER BRIDGE, *East India Railway.*—Specifications, drawings, and bills of quantities, at the Office, East India Railway House, Alderman's Walk, London. Tenders August 16.

WROUGHT IRON PLATFORM, *Berks.*—At Able Bridge. Plans, &c., with bills of quantities and forms, Mr. J. B. Carey, County Surveyor, 90 Broad-street, Reading. Tenders, August 24.

IRON PIPING, *Bolton.*—1,150 lineal yards of iron pipes of 12 inches diameter, and a further quantity of 2,400 yards of 6 inches diameter. Particulars, Borough Surveyor, Corporation Offices, Acres-field.

IRON ENTRANCE GATES, *Hanley.*—And fencing to the Borough Cemetery. Particulars, Surveyor's Office. Tenders, August 17, to the Town Clerk.

CHAPEL, *Morley, near Leeds.*—For the erection. Plans, &c., by applying to the Chapel Keeper.

CEMETERY CHAPEL, ENTRANCE LODGE, BOUNDARY WALL, &c., *Farnley.*—Drawings, office of Mr. Hill, Architect, 71 Albion-street, Leeds. Tenders to Chairman of Board to August 23rd.

PARSONAGE, *Pitcombe, Somersetshire.*—Plans, Rev. Vernon Taylor, Wyke, near Bruton. Tenders to August 20th.

SCHOOLS, *Little Hodham, near Bishop's Stortford, Herts.*—Plans, &c., Mr. G. E. Pritchett, 12 Bishopsgate-street Without, and Bishop's Stortford. Tenders to August 19th.

SCHOOLS, *Epping, Essex.*—For the erection of 3 large schools and double residence. Plans at offices of the Architect, Mr. G. E. Pritchett, 12 Bishopsgate-street Without, and Bishop's Stortford. Tenders to August 19th.

SEWERAGE WORKS, *Manchester, Township of Cheetham.*—For sewering, paving, &c. Plans, Mr. William Frances, Surveyor, Town Hall. Tenders to August 26th.

REMOVING ASHES, &c., *Bradford.*—Emptying and carting away the contents of all ash-pits and cesspools within the district of the Local Board of Health for one or three years, from the 1st of September next. Tenders to the Chairman, the Office, Mill-lane, Bradford, (where any further information) August 22.

NEW MARKET OR SHAMBLES, *Pontefract.*—Plans and specifications at the Town Hall. Tenders to H. J. Coleman, Esq., Town Clerk, before the 28th instant.

FOR TAR.—Tenders for the tar which shall be produced at the Surrey Gas Works, Rotherhithe, S. E., during the 12 months commencing 1st Oct. next, will be received there until the 18th instant.

ATLANTIC CABLE.—The Atlantic Telegraph Company invite inventors, patentees, and manufacturers of submarine cables calculated for laying across the Atlantic, to send the same to the Secretary of the Company, (Mr. George Saward, 22 Old Broad-street) together with any description they may desire to append to them, in order to their being submitted to the officers of the Company, and by them to the Consulting Committee for the purpose of examination, testing, and experiment.

PLANS FOR MARKET-HALL ROOF, *Wolverhampton.*—Designs to be forwarded to the Borough Surveyor to 27th of August. Plan and particulars at the offices of the Borough Surveyor.

TOWN SURVEYOR, *Bilston.*—To take charge of the roads, make plans, superintend all contracts connected with the sewerage, water supply, and all other works, from time to time carried on by the Commissioners of the Township. Salary £100. Applications to Mr. Viles, Clerk, August 15.

SURVEYOR.—Accustomed to town work, the use of the theodolite, able to plot his own work, and make a finished plan. Applications stating real name and address, age, previous employment, and salary required, Box 64, Post-office, Manchester.

SURVEYOR AND INSPECTOR OF NUISANCES, *Moss Side, Manchester.*—To undertake the entire duties, and to devote the whole of his time as Surveyor and Inspector of Nuisances. Salary not exceeding £100 per annum. Application in writing to the Clerk, (Mr. J. H. Hampson) August 31.

INSPECTORS OF GAS FITTINGS, *Manchester Corporation.*—Two. Must be practically acquainted with the business. Salary £90 each. Applications, with testimonials, to the Chairman of the Gas Company, York Chambers, Kingstreet, August 24.

GAS MANAGER.—A steady active man to undertake the management of a small gas work, and make the gas. One who understands fitting will be preferred. Applications, with references, Mr. Munday, Maddeley, Salop.

WORKING GAS MANAGER.—For the Uttoxeter Company, to attend to the making of the gas, laying the services, fittings, &c. Wages, 30s. a week, with house, coal, gas, and allowance of £1 a year, in lieu of garden. The manager to pay his own stoker out of the above wages! Applications in writing to Mr. Fradgley, Architect and Surveyor, Uttoxeter.

FOREMAN MOULDER.—Accustomed to first-class engine and tool work. Box 32, Post-office, Manchester.

BLEACHWORKS MANAGER.—One who can take the whole management will be respectably treated with. References required. X, 99, *Guardian* office, Manchester.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 19, 1859.

OUR NATIONAL DEFENCES.

IT is a comforting thing to know that while so many are deploring our want of national defences, so many are also telling us of innumerable methods by which we may readily secure ourselves from attack. One informs us that we may do this by building twice as many line-of-battle ships as we now have; another advises us that half-a-dozen steam rams will make us safe; another, that five hundred gunboats will answer the purpose; another, that fifty thousand additional seamen are all that we need; another, that a marine militia manning gunrafts is the thing; another, that martello towers and land batteries alone need multiplication; another, that railway batteries from point to point of the coast would make us invulnerable; another, that a large increase in our militia force would be an ample safeguard; another, that a triplication of our standing army is alone desirable; and so on.

It would be mere pedantry in us to pretend that the question of our defences is a simple one. It is far from it: and he is a wise man who keeps his mind ready for the free reception of any new light that may break upon the subject. Such a man will have his eyes open to all that transpires in reference to our naval and military forces, and especially to the *matériel* of our army and navy. We have ourselves looked through very many of the numerous disquisitions which writers who know something and others who know nothing of the subject have written, and it may be of service to many of our readers if we say that the best of them is, in our judgment, that which appears in the July number of the *Quarterly Review*. This article is from the pen of a gentleman who has good grounds for speaking confidently on some of the important topics embraced by his remarks, and who has taken pains to acquire reliable information on others of which he may properly be supposed to have known less.

We observe with pleasure that the author of this able paper, while exceeding on some points the statements which we have made, on others most strongly enforces what we have frequently urged during the last six months. On the subject of iron-coated ships of war, for example, he writes much to the purpose. After alluding to the experiments which have been made in connection with this subject, and remarking that, as we have often said, we cannot hope to make our ships proof to solid wrought-iron shot, but have the means of making them shell-proof, he says when this conviction was forced upon the Admiralty they began to stir themselves; "and, "after having obtained designs and tenders "from the six most eminent iron-shipbuilding "firms in England, they have given orders to a "newly-formed 'Limited Liability Company,' "who, whatever their other qualifications, can "by no possibility have the necessary experi-"ence." If, however, he continues, they do execute their contract, this one vessel may be ready for sea in June next. It is said the Admiralty will then consider whether or not they ought to proceed further. In the meantime—says our Reviewer—it would be difficult to find a single naval officer of ordinary intelligence who is not aware that the day of wooden vessels of war is past, and that when two ships approach within fighting distance, one at least will be disabled, probably sunk or burnt, in a very few minutes. "In fact, nothing can keep "the seas but incombustible shell-proof vessels." The one question which remains open seems to be whether or not wooden ships coated with iron slabs of only one or two inches in thickness would not meet most of the difficulties of the case. If so, we could in a short time convert some of our wooden walls into efficient vessels of this class; but it is nearly certain that if any other nation should possess shell-proof fleets, while we do not, they may be able to wrest the dominion of the seas from us by the employment of this expedient alone. The cost of providing such ships must, of course, be very considerable. The danger, however, is so imminent that the outlay is indispensable to our safety, and not one hour should be lost in attempting to overtake our rivals. The money spent in providing a squadron of six or seven of these ships would probably do more to ensure our supremacy on the ocean than any other outlay which can at present be suggested. It is true that the French vessels may not—indeed, cannot—turn out to be first-rate sea-boats, nor capable of being used on long voyages; but they certainly will be equal to a cruise across the Channel, and for covering a disembarkation of troops, and employed against shore batteries would prove of the utmost importance. The French therefore possess an arm which we do not, and which we cannot have by any exertion within twelve months. If it proves as important in practice as the best informed assume it to be in theory, its absence may suffice to turn the tide of battle against us. All this we have often said before, and we only say it again because of the new interest which the *Quarterly* has given the subject by reviving our statements, and because the subject itself is of vital importance to the nation.

In discussing the probable effect of steam propulsion in favour of the attack or defence of our shores, the Reviewer adduces considerations which well deserve attention. He notices particularly the difficulty of blockading an enemy's port by a steam fleet. As it is manifestly impossible that a fleet can carry a sufficient quantity of coal to blockade under steam alone, the squadron keeping the sea must be fully rigged; while the enemy issuing from their cover under steam, and if they please without masts and spars, would have an immense advantage. This last condition, of the issuing enemy being without masts and spars, is a most important one. All will, as the Reviewer says, recollect the dreadful fate of the steam-ship Prince in the storm off Balaclava. She was a screw vessel steaming successfully to windward, and in a few minutes would have been safe, when the order was given to cut away the mizen for the purpose of easing her. It fell overboard and fouled the screw, when she at once became an unmanageable wreck, and perished with all on board. And why may it not be so in future naval actions? One shell in a mast will suffice to send it by the board, and the screw will certainly draw in some part of the wreck. If once the ropes become entangled with the screw, it must either be disconnected, raised upon deck and freed, or the vessel will become helpless, and altogether incapable of moving or steering. So apparent is this danger, that many officers are inclined to recommend a recurrence to the old paddle-wheel instead of the screw—at least for small vessels, not requiring many guns. Sir Howard Douglas, as our readers know, proposes to greatly diminish the chances of evil in this respect by altering the form of the leading edges of the screw blades, shaping them so that they may act like knife-edges, and clear themselves of ropes or other encumbrances. The results of late experiments on the Doris pointed so strongly to other advantages associated with the changes proposed by Sir Howard, that we are at a loss to know how it is that further experiments have not already been instituted. Sir Howard has made application, we believe, for permission to have his plan carefully tested under his own superintendence on board a ship of war; and when the eminent services already rendered by him to the navy are considered and to these are added the promise of success which the experiments just referred to afford, there can be, we think, no reasonable, or even justifiable, grounds for a refusal to his request. The Quarterly Reviewer considers the defect in question—the fouling of the screw—would be cured by adopting an arrangement which, he says, "has been used in the mercantile marine "with perfect success for the last five or six "years." This consists in placing the screw quite free of, and entirely behind the sternpost, instead of in an aperture in the deadwood of the vessel, and then, by making a joint or hinge in the screw shaft, it can be easily raised outside the vessel without being disconnected. In this position it is almost as little liable to be fouled as a paddle-wheel; but if the accident should happen, it can be cleared and lowered again in a few minutes. "It is merely neces-"sary," says the Reviewer, "that there should "be two sternposts instead of one, placed side "by side, with a slit between them, up and "down which the shaft can be moved with "facility. The rudder is placed wholly below "the screw-shaft, and entirely out of danger. "Such an arrangement of the screw seems to "get over all the known difficulties without any "counteracting disadvantages, and why it is "not adopted is one of those mysteries only "known to Admiralty Boards." If the Reviewer is right, and this plan—which was originated, we believe, by Mr. Scott Russell, and is in use in some of his vessels—can be adapted to ships of war of all classes, its adoption would undoubtedly add enormously to their safety.

Gunboats are a class of vessels upon which careful attention is bestowed in the article before us. For defensive purposes they are of the utmost importance, and are by no means an expensive expedient. In the good old times it used to be estimated that every gun on board a man-of-war cost £1,000. Owing to the changes which steam has introduced this is now nearer £2,500 in a line-of-battle ship, £3,000 in a first-class frigate, and £3,500 in a corvette. The iron-coated ship building at Blackwall will cost not less than about £8,000 per gun! Whereas a single-gun gun-boat can be built for £2,500, and, if protected with iron, for at least as small a sum per gun as the large vessel of the same kind. As the "light infantry of a fleet" to protect harbours and prevent a landing, they would be invaluable, and, what is very important, they can easily be built in private yards in any number and in very much less time than would be required for a proportionate increase of the regular navy. A thousand of them would certainly, as a subsidiary force, go further to render our shores free from insult than ten line-of-battle ships. They would also be far more easily manned, being a class of vessel which our fishermen and coasting sailors would gladly volunteer to serve in. A fleet of gunboats would also be far less liable to disaster, for the destruction of one or two would hardly be felt in a squadron. If overpowered, they could escape into creeks and shallows, where they could not be followed; and there is no class of warfare, as the Reviewer says, which would tend so much to bring out the best points of an Englishman's character and seamanship as a guerilla warfare of this sort. A fleet of gunboats of our own would also enable us to defend Woolwich and London from an attack of foreign gunboats ascending the Thames. This we have no pre-

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sent means of doing. Tilbury and other land forts would be useless for such a purpose, for vessels under steam cannot be hit with any degree of certainty from the shore. We have it on the authority of Captain Coles, the designer of the Lady Nancy raft, that our gunboats were frequently attacked by Russian artillery from the shore during their expedition in the Sea of Azoff, but always with little or no effect. And no doubt French or other gunboats might traverse our rivers at high speed with the same impunity. A fleet of gunboats of our own would not only remedy this defect in our defences, but would also give us the power of carrying successful war into the hearts of hostile cities.

THE NEW WORKS DEPARTMENT OF THE ADMIRALTY.

THERE are many men who possess, or affect, an imperial tone who have nothing imperial in their faculties. While too haughty to take counsel of others, they have not the ability to do wisely of themselves. There are many small administrators of this kind in office, and we pay very dearly for them. Indeed such men are in every department of the Government putting terrible burdens upon our shoulders, even if they are not, as some suppose, jeopardising the very power and honour of the nation. There is not a man of any observation among our readers who has not been more or less pained and chagrined by the acts or the no-acts, the folly or the supineness, of such officials.

Now, we do not wish to bear hardly upon any man or men, but the time has come for us to say that the New Works Department of the Admiralty seems to be managed with too much hauteur and too little knowledge. From many quarters, and for a long period, we have received complaints of the manner in which the buildings, roads, and other like constructions have been carried out in our dockyards, under the management of Colonel Green and his assistant, Mr. Scamp. It would really appear — monstrous as the statement may seem—that it is the habit of these gentlemen to conduct their works with little or no reference to the desires, or even to the necessities, of the officers for whose uses they are intended. For example, a man of plain sense would suppose that if a building, or set of buildings, is to be erected for the use of the factory in a dockyard, the chief engineer of that factory would be consulted upon all the main and most of the minor features of the work, since it is he who has experienced the necessity of what is wanted, and it is he also who will have to put it in operation when it is constructed. But not so: the two gentlemen at Somerset House, being men of uncommon sense, consider themselves the proper, and too often the only, persons whose knowledge is to be made available, and whose wills are to be consulted. The fruit of all this is, that of late years our great and costly dockyards have been cut about and blocked up in a most remarkable manner. In Sheerness Dockyard, for example, of which we know perhaps more than any other, some truly abominable changes have been made, especially in the architecture of the place. A few years since the centre of the yard was occupied by a large and noble four-sided brick building, used as a storehouse. This building stood quite alone, and at a sufficient distance from all others to produce its full architectural effect, which was very imposing. At a short distance from it stood the blacksmiths' forge—a building, of course, of a totally different style and character, but not sufficiently near to break the unity of effect which the larger structure produced. Of late years, however, the gross folly—one might almost say sin—of connecting these two buildings by blank brick walls has been perpetrated; and thus on three sides the beauty of a large and costly edifice has been not only marred, but destroyed altogether. Again; until recently the entire harbour-face of the same dockyard consisted of a continuous line of granite wall, straight and uniform from end to end, and relieved by breaks at the basin entrances. Lately, however, a black wooden structure has been built out into the harbour near the middle, and now stands there an annoying and enduring defacement of what was before pleasant to behold.

But let it not be supposed for a moment that egregiously bad taste is the only, or the worst, thing we have to charge the Department of the Director of Works with. A man may have no soul for art, even in its most manifest forms, and yet know how to dispose of space judiciously, to build a workshop efficiently, or to lay a roadway securely. These things, however, or at least some of them, seem to be beyond the ability of the Director of Works and his people. If any man with two eyes in his head, —or indeed a man with one eye, or even "half-an-eye"—will take the trouble to walk through Sheerness Dockyard just now, he will see plainly enough that the laying down of a road for a wheeled truck to run upon is an undertaking that Colonel Green and Mr. Scamp, or their subordinates, are not yet in a position to accomplish satisfactorily. In that yard a very excellent and economical system of transporting and storing boilers has been devised and introduced by Mr. Blaxland, the Chief Engineer of the establishment. The boilers of many of the steam ships now continually lying in the dockyard or harbour at that port have in many instances to be transported to and from the factory for repair, and when their repairs are completed have to be stood aside, often in considerable numbers, until they are again required for use on board ship. The transport of these boilers by means of the ordinary appliances of the dockyard was found to cost so much for labour, and to be attended by so much delay, that Mr. Blaxland set about proposing a remedy. He has accordingly devised a pair of trucks or carriages, of which the lighter runs off and on the heavier, upon rails. When a boiler is to be removed the upper carriage is run in beneath it upon rails, and the weight of the boiler is received upon it. This upper carriage, with the boiler upon it, then retraverses the rails, and is received upon the main carriage which bears it away to the storing ground. There are many and great advantages attending this system, one of the chief being the extreme facility with which the boilers when stored could be got at and hurried away to the ship in case of an emergency, every thing which facilitates operations of this kind being of great value in these times. Another similar and equally important advantage attending the plan is, that pairs or sets of boilers can be readily placed in their proper relative positions on the storing ground, and there have all their pipes and other appliances fitted to them, so as to be fully ready in all respects to be put together for service at the shortest notice.

Now this arrangement, which reflects great credit upon its author, and is calculated to save the country much expense, requires, manifestly, that a road suitable for the main carriage to run upon from place to place should be laid down. The construction of such a road was accordingly undertaken by the Director of Works; and how does the reader suppose this gentleman and his colleagues have formed it? With an amount of wisdom which it requires a great stretch of faculty to duly appreciate, they have constructed it of small detached blocks of wood stood up on end upon a shallow layer of concrete! The consequence is, as the carriage wheels roll along, little block after little block sinks beneath them, and every succeeding block of course becomes an obstacle to the carriage's progress. Three times the power which would be sufficient to move it over a hard and firm road is consequently required, and the road-way itself, although new in many parts, is already so rugged as to be little or no better, or more suitable for the purpose, than the stone road-way before us here in Fleet-street! No one, if he should think our statement of facts too bad to believe, need receive it simply upon our allegation. He can go to the dockyard, and walk over the ground himself, and gradually—for it takes time to do it—gradually, we say, persuade himself that what he sees is real and true.

So bad is the management of this department of new works now under notice, that even Mr. Murray, although he had so much that was strange of his own to discourse upon, could not help going out of his way to attack it in his late manifesto. He says:—"With respect to "new works, the Committee found a general "expression of dissatisfaction on the part of the "practical officers, both as to the opportunities "afforded to them for expressing their opinions "on works intended for their use, and the "little attention paid to their representations "when made; and the Committee feel obliged "to express their opinion that much loss has re-"sulted to the service from this cause. At the "same time, opportunities appear to have been "given to the practical officers occasionally to "state their views; but from this having been "done generally in a cursory manner in conver-"sation, and the opinions having been given "hastily, and sometimes, perhaps, not under-"stood, or not appreciated, the result has been "very unsatisfactory. Perfection in arrange-"ments, and consequent economy in manufac-"turing, depends much upon the details of the "buildings in which the work is to be carried "on; but the Committee have found that many "buildings have been far advanced before the "details were determined upon, and inconve-"nience in the position of the necessary adjunct "buildings and other evils have resulted. The "practice prevails of the clerk of the works "being directed to consult with the other "officers and make out plans, and these plans "have then been forwarded and final plans "have been sent down from London, and the "contract taken and the work begun, without "any of the officers, for whose use the works "were intended, having seen them."

This is not a very luminous statement, but it reaches, however indirectly, the point we are aiming at; and for the sake of backing up facts which we have seen with our own eyes, we do not mind raising even Mr. Murray's report to momentary importance. There need be no fear of its speedily sinking again to its due obscurity.

THE BUILDERS' STRIKE.

BOTH men and masters have an undoubted right to combine for the management of their own affairs; but union is strength, and when men are very strong they are exceedingly likely to abuse their influence. Workmen, who have been very fond of combining of late years, have undoubtedly gone very wrong in this respect. Without discussing doubtful details, we may mention one great instance of their tyranny: they constantly refuse to work with men who have not joined their trade societies. In many instances they have struck work simply because a non-society workman has had employment given him by the master.

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Although this has not yet been made a legal offence, it is a moral one; for it practically deprives the master of his fair degree of liberty, and imposes a heavy penalty upon every man who conscientiously objects to share the proceedings of the societies.

To resist such mischievous and tyrannical proceedings as these the masters would do well to combine, and it would be a blessing to thousands of workmen, as well as to society at large, if they became triumphant in their resistance, and put an end to the despotism of trades unions. For success on this one point *would* destroy the "despotism" of such bodies. If working men were free either to join or to stand aloof from such societies, without suffering personal loss, all the oppressive powers of the societies would at once cease. It is only because they have contrived to impose a penalty upon the working man who dissents from them that they have become so strong and overbearing. If, therefore, the Metropolitan master builders had been well-advised, they would not have insisted upon the men promising not to combine at all on the labour question, because the men have an undoubted right so to combine if they please. What they should have insisted upon is, that the men whom they employed should pledge themselves to abstain from that particular act of tyranny which we have pointed out, and from such other specific acts of a tyrannous character as they, the masters, may be able to mention. This would have commanded the unanimous approval of the press, and would have left the society men without any plausible pretext for resistance. At any rate it would have brought the real and not an imaginary case forward for decision, and would have given the men no chance of selecting false ground for their battle-field. As it is, we have the men on the one side contending for an arbitrary limitation of working hours, and the masters on the other enforcing an equally arbitrary arrangement of their own.

That the men's demand for the enforced reduction of the working hours from ten to nine is an arbitrary and unfair demand is shown by the fact that it is only by the tyrannous acts of the societies that it can be maintained. If non-society men were permitted to exercise free trade in their labour, we should hear nothing of the nine hours' movement. And that they ought to be permitted to do this there can be no doubt. Lord Brougham, in his "Rights of "Industry," has stated the terms of the workman's freedom most clearly, and these terms are all that a reasonable man can require. "There can be no doubt," he says, "that the "labourer has rights over his labour which no "government and no individual should presume to interfere with. There can be no "doubt that, as an exchanger of labour for "capital, the labourer ought to be assured that "the exchange shall in all respects be as free "as the exchanges of any other description of "property. His rights as an exchanger are, "that he shall not be compelled to part with "his property, by any arbitrary enactments, "without having as ample an equivalent as the "general laws of exchange will afford him; that "he shall be free to use every *just* means, either "by himself or by union with others, to obtain "such an equivalent; that he shall be at full "liberty to offer that property in the best market "that he can find, without being limited to any "particular market; that he may give to that "property every modification which it is capable of receiving from his own natural or acquired skill, without being narrowed to any "one form of producing it. In other words, "natural justice demands that the working man "shall work when he please and be idle when "he please—always providing that if he make "a contract to work he shall not violate that "engagement by remaining idle; that no labour "shall be forced from him, and no rate of payment for that labour be proscribed by statutes "or ordinances; that he shall be free to obtain "as high wages as he can possibly get, and "unite with others to obtain them, *always providing, that in his union he does not violate "that freedom of industry in others which is the "foundation of his own attempts to improve his "condition;* that he may go from place to place "to exchange his labour *without being interfered "with by corporate rights or monopolies of any "sort, whether of masters or workmen;* and "that he may turn from one employment to the "other, if he so think fit, without being confined to the trade he originally learnt, or may "strike into any line of employment without "having regularly learnt it at all."

These are the conditions on which working men exercise their labour and skill in this country. If the conditions are wrong, or can be improved, let us have the subject amicably discussed, and a public understanding arrived at. It is mere folly for the builders or any other class of men to attempt to set them permanently aside by the coarse coercion of strikes; and it is also mere folly for masters to meet the coercive measures of the men by any mode of action which is opposed to these conditions.

THE NEW BRONZE COINAGE.

FROM the evidence of Doctor Graham, Master of the Mint, as given before the late Decimal Coinage Commission—that is, before Lord Overstone—we gather that gentleman's opinion as to the value of bronze as a material for coins, which opinion, on the eve of a new coinage of mixed metal, becomes especially valuable. In July, 1857, the present Master of the Mint stated that the French Government had materially diminished the size of the inferior coins of the French empire, and that the change had been a very popular measure. He also believed that a similar alteration might be beneficially made on this side of the Channel. As in France bronze had been used in place of copper for the new currency, so would he have it used here. When questioned as to the proportions of the various metals necessary to form a mixture at once hard and attractive in appearance, Dr. Graham replied that the bronze of the ancients could scarcely be improved upon, and that the French bronze was analogous to it. Bronze, said this eminent authority, has numerous advantages over copper, of which the preservation of the coin in a better condition is one; among its other advantages may be mentioned that in consequence of its being much harder than copper, the pieces of money struck from it may be considerably thinner, so that lightness might be obtained without an inconvenient sacrifice of size. One remarkable advantage, too, it possessed, which was that counterfeit coins could not be made to resemble in colour coins of mixed metal. It was possible, and, indeed, easy to coat metals by the electrotype with pure copper, but it was impossible to coat them with a composition like that of bronze. Further testimony of a similar kind or tending in the same direction was given on this occasion by the Master of the Mint, and it must be very satisfactory to the public to know that in the new bronze they are likely to get, in all respects, a better article, and one which will be much cheaper, than the pure copper coinage of which the Mint, we may suppose, has now struck its last piece.

The chief misgiving we now have upon the subject of the new issue of bronze monies is, that it will be too long about. Of the task of producing the large number of tons necessary for effecting a simultaneous exchange of old coins for new ones, it may be said in the language of Shakspeare:—"If 'twere done, when "'twere done, then 'twere well 'twere done "quickly." We have before had occasion to speak of what was accomplished in 1816-17 with regard to the exchange of the worn and torn silver coins of previous dates, and it would be idle to suppose that the Mint could not effect very much more now than it did then. Nevertheless, increased facilities, mechanical and otherwise, would doubtless be required. The vote of £10,000 does not seem large enough to commence so gigantic a work as the creation of 6,000 tons of new coins; but judiciously laid out it is certain that much may be done with it. Converted into pence, halfpence, and farthings, of something like the dimensions adumbrated in our last article, and bought up by the public, the £10,000 would soon be quadrupled, and Government would thus have increased capital in hand wherewith to go again into the metal market. Perhaps, indeed, this is the thrifty and economical design of the Chancellor of the Exchequer. The hon. gentleman, aware of the "ignorant impatience of taxation" existing among Her Majesty's lieges, thought that he had better tone down his demands, and whilst exhibiting his own knowledge of commercial economy quiet the grumblers inside and outside the House. At any rate, this is a much more rational theory for reducing the estimate to one-fifth of the sum originally considered necessary, than the notable one of buying the plant for a contractor's mint at Birmingham or elsewhere.

We shall be glad to hear that the authorities of the Mint are looking the important duty fully in the face, and taking effectual means to accomplish it. Speedily, we learn, the steam power of the establishment will be equal to 100 horses, and surely no paucity of mechanical appliances should prevent the production of as great a quantity of coins as this power properly employed would effect. Nothing less than two millions per week ought to be the rate at which Her Majesty's benign features should be impressed upon the new bronze discs at the Mint, and this is a speed which, without contractor's aid, might, we think, be easily attained there.

As to the designs for the coming coinage, we have already suggested the advisability of open competition among engravers—with the offer of a prize or prizes—and we now propose, in addition, the nomination of a *mixed* jury to decide as to the merits of the various works. We say a mixed jury advisedly, for a purely artistic one would not do. You must have something more than a beautiful and appropriate creation of the mind and the pencil; you must have that which will not only show well on paper, but which may be easily and rapidly transferred after engraving from the die to the disc of metal to be impressed. In short, the accepted design must be one which will look well, coin well, and wear well. Hence the necessity for a *mixed* jury—half practical, half artistic.

The Mint engraver might, of course, compete with out-door artists, and the award would, no doubt, be given to the most meritorious and practicable design. It will be, in this instance, too late to retreat when once the "die is cast," and hence our urgent desire to make sure of winning. To stamp into existence in England, in 1859, a new coinage which would not in all respects—artistical, mechanical, proportionate, and durable—bear a favourable comparison with any coinage in use abroad, would be to stamp ourselves with indelible disgrace. National works have, however, so often proved

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national failures, that there is some reason for anxiety even in the introduction of a new coin. Whilst, therefore, all proper haste in effecting the reform is counselled, and red tapery is denounced *in toto*, it may be hoped that sufficient care will be taken to guard against an error which would be irretrievable. Doctor Graham is, no doubt, sensitively alive to the responsibility of his office, and in his hands the public interests so far are in safe keeping.

FREE DRINKING FOUNTAINS.

Not until this year of grace 1859 have we English people had the good sense to give the poor men, women, and children of our streets a free cup of cold water in the name of Christian charity. In this metropolis and other large towns we have, by our neglect, driven our poor street population incontinently into the beer-house and dram-shop. We have been very loud and very active in our zeal for the working classes. We have exclaimed against their drunkenness and sighed over their depravity; established huge societies for their reform and built churches for their salvation. And we have doubtless in these ways done much for their good. But the simple expedient of putting up a water fountain in competition with the gin-shop—of offering a free cup of pure water instead of an expensive glass of fiery poison, has not until now occurred to us. All honour to Mr. Melly, who, a year or two since, began the humane work! All honour to Mr. Smithies, to Mr. Wakefield, the Earl of Carlisle, the Earl of Shaftesbury, and others, who have followed his noble lead!

We are not very much enamoured of what are called philanthropic movements in general. The good spirit which prompts them often perishes in the mere act of forming an organization for itself to work with, and the organization itself becomes what Mr. Carlyle would call a "galvanized corpse," in which we see no beauty. But we believe in the work which the Metropolitan Drinking Fountain Association has undertaken. There is nothing questionable in its objects; nothing doubtful in its agency. Already the poorer population of London are drinking with delight of its bounty. On another page we give a list of no less than about seventy sites on which the crystal cup is already sparkling, or is about to sparkle. And yet the Association has been at work for four months only!

In this day, when "bitter beer" is the continual cry of so many pompous mouths—when claret is giving its colour in so many cups—when champagne is "moving itself aright" in so many glasses—when Catawba wine with its taste divine, "dulcet, delicious, and dreamy," is filling so many rooms with its "sweet perfume"—in this day, we say, it may seem old-fashioned to put in a good word for mere water; and yet we do not hesitate to say that clear, pure, bright water still appears to us as sacred a thing as it did to Him who eighteen centuries since chose it as the best symbol of life which this world afforded. It is, indeed, the greatest physical gift of God to man. There is nothing we have which we would not sooner forego than water. How desirable, then, is it that a thing so excellent, and so abundant withal, should be placed within the reach even of the poorest poor.

We cannot undertake here to mention all the advantages which the new drinking fountains will offer to the labouring classes. We may say, however, that they will afford most welcome refreshment to the thousands of working people who are employed far from home—that thousands who even at home have no pure or sufficient water supply will drink at them with gratitude—that most of those who do drink at them will imbibe a healthier fluid than the poor are commonly supplied with (the whole of the fountain water being carefully filtered)—that in times of prevalent disease these fountains will supply a most valuable and unstinted antidote—that the temptations and risks to which the poor are exposed in beer-shops and other like places will no longer be forced upon them—and that, as a consequence of all this, we may fairly anticipate a great reduction in the vices and crimes of the lower orders.

Experience has already gone a long way in confirmation of these statements. Let us quote a remark or two on this point from Mr. Wakefield's able pamphlet, "A Plea for Drinking Fountains," which we would strongly commend to the notice of our readers. The author says: "The fountains in Liverpool have been used to "an extent exceeding the most sanguine expectations of their founder. The results are "given in a tabular statement of the working "of thirteen of the fountains erected by Mr. "Melly. They may be generally stated thus: "in one day, of about 13 hours 8 minutes, "24,702 persons drank at 13 fountains; or, in "other words, one person drank at each of the "13 fountains every 25 seconds for 13 consecutive hours; at one fountain as many as 3,340 "persons drank in 12 hours, being an average "of one drinker every 11 seconds; there were "five other fountains at each of which above "2,000 persons drank; or, taking all the fountains, there was one drinker for every two "seconds throughout a day of 13 hours." These registries were not all made, we are told, in summer; fewer persons, but still a considerable number, drink in winter. Allowing, however, for this Mr. Melly observes that "a calculation "based upon a series of observations taken at "different seasons, and in different parts of "the town, by persons of perfect reliability, "employed for the purpose, gives an average "number of upwards of 1,000 drinking every "day throughout the year at each of the 40 "fountains scattered throughout the town and "its outskirts." This would give 15 millions of persons who annually drink at the Liverpool fountains. And subsequently, in March, 1859, Mr. Melly writes that he is "quite sure that if "20 more fountains were judiciously placed "here (Liverpool) both the new and old fountains "would average 1,000 each the year round;" that is, if Liverpool were adequately supplied with fountains they would be used 22 millions of times in the year! In other provincial towns, the experiment has been attended with like results.

If such have been the results in the provinces, it will be conceded, says Mr. Wakefield, that drinking fountains would be even more used in the Metropolis. The greater radiation of heat from a larger surface of buildings, less shade, more smoke and dust, and longer street distances, combine to make London a more thirst-exciting place than any provincial town. It is gratifying to state that the result of the experiment of the first drinking fountain erected by the Association in St. Sepulchre's church, on Snow-hill, fully confirms the above. This fountain is used about 7,000 times daily. It will be observed that this is more than double the number that drank at any one of the forty-three fountains erected in Liverpool. "As one "of the many gratifying evidences of the prac"tical usefulness of these fountains, it may be "stated," says Mr. Wakefield, "that a gentle"man who largely employs workmen in iron"works, in the town of Wednesbury, having "recently erected fountains for his workpeople, "says, that his manager has since observed an "improvement in their habits, and regularity "of attendance; attributable to their decreased "use of beer, in consequence of the facility of "obtaining pure water which the fountains "afford." It would be difficult, he adds, to exaggerate the gratitude of the poor for these fountains, testified not only by the great numbers who flock to them, but by their many grateful acknowledgments in words and looks, as they quaff the pure cold water to allay their thirst.

We commend this subject to the regards not of London readers only, but also to those employers of labour throughout the country whom it is our privilege to address. Let us distribute freely to our mechanics and to our poor people that healthful and cheering fluid which Heaven has bestowed upon us so copiously, and we shall thus remove from them both the excuse for, and the occasion of, their worst sin.

THE CORT FAMILY.

Parliament has just voted £5,000 as a compensation to Mr. Barber for the mistake which was made in transporting him, and no one can possibly object to the arrangement. But it certainly seems strange that a Parliament which can show itself so just in a case of purely individual importance, can do nothing to cancel the effects of that great act—of villainy, one is tempted to say—by which the family of the great Cort was impoverished. Hear, reader, once more the simple tale:—"In bringing his "inventions to perfection, Henry Cort expended "a considerable private fortune, and even sa"crificed one half of his patent rights, after "which the remaining half, together with all "his other property, works, trade, and con"tracts, were confiscated by the naval autho"rities, in 1788, for the debt of a partner (a "Government servant who became a defaulter), "not equal in amount to one-tenth of the sum "afterwards produced from them. The family "of this man, who thus nobly enriched his "country to the ruin of himself, have, we most "respectfully submit, higher claims upon the "nation than any Government has ever yet re"cognised, although several Ministers of the "Crown have, from time to time, aided them, "none more promptly or more liberally than "your lordship (Lord Derby) and Lord Palmer"ston; some, it is true, have received small "pensions, and all have been participants of the "very limited funds dispensed by the Royal "bounty; but not one has been raised a single "step from indigence, nor is one at this mo"ment above want." This is the language of a memorial which has been signed by one hundred and thirty of the foremost manufacturers and men of science of this age and nation, addressed to two Prime Ministers in succession; yet nothing but donations from the Bounty Fund, infinitesimal pensions, and *promises* of suitable recompense hereafter, can be elicited from those noble-blooded personages.

But we must not be severe upon Ministers of the Crown when we find that those men of princely fortunes, the great ironmasters, who have been made princes by Henry Cort's inventions, and by them alone, show no gratitude to the man who made them. Not long since Mr. Fairbairn, moved by the long neglect which Henry Cort's children have had to suffer, offered £100 in the columns of the *Times* as the commencement of a subscription for the family. That generous and disinterested offer elicited, we are ashamed to say, not a single response. It is true that small subscriptions have of late years been given by a few ironmasters towards a Cort Testimonial Fund; but these deserve no mention side by side with Mr.

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Fairbairn's noble letter, or in the presence of the great wealth which Henry Cort's inventions have created. The money value of the exported iron, iron machinery, and other articles made from iron, which was nothing in 1783, was, for the one year 1857, no less than £22,994,671 sterling; and the whole gain which this country has derived from the said inventions during the last seventy years, is estimated, in the "Encyclopædia Britannica," to amount to £600,000,000 sterling, as was stated in a Memorial signed by twenty-five of the most eminent authorities, supported by sixty Members of Parliament, including two Cabinet Ministers, presented in 1857 by Lord Stanley to Viscount Palmerston. This enormous addition to the wealth of the nation is quite independent of the collateral advantages resulting from the joint development of engineering, mining, agricultural, manufacturing, and every other branch of industry in which iron is largely employed. No ironmaster can therefore mention the £5 which he gave a year or two since as an excuse for not following up in a worthy spirit the lead which Mr. Fairbairn held out.

But the Cort family is even yet, we believe, destined to see brighter days. The whole of the facts of the case have been laid before Mr. Cobden, whose clear and energetic mind was at no loss to master its dark details, and whose generous goodwill has not failed to manifest itself on behalf of these aged people. He has promised, we learn, to aid their cause to the full extent of his influence, and we entirely believe he will do so. We wish to cast no slur upon any parliamentary personage who has hitherto interested himself on the behalf of—we will not say the Cort family, but the national honour, which has been stained by the treatment of that family. But we do say we would rather hear that Richard Cobden had whispered one syllable in favour of the cause, than learn that all the others whom we have named had agreed to promote it together. And this we say because we believe Mr. Cobden is a man of sounder sense and purer integrity than most of our great politicians. We say nothing here either in favour of or against his political principles; but we do believe him to be as sensible and reliable a *man* as there is in Parliament. He is consequently very influential in those counties in which he is best known, and we doubt not he will find means of using his influence for the furtherance of justice in the Cort case. It will indeed redound to the honour of Mr. Cobden, Mr. Fairbairn, and the friends of each of these gentlemen, as well as to the honour of Lancashire and Yorkshire, if the great manufacturers of those counties conduct this case to an honourable conclusion. They may well do so; for the inventions of Henry Cort, by giving us the iron of the steam engine, have benefited every branch of manufacture in which machinery is employed—the cotton trade to the extent of many millions sterling annually. We need not say what Cort did for Free Trade. He was really a promoter of that great modern movement; nay, he it was who taught us the secret of our own iron-producing power, and thus laid the basis on which so much of our modern trade and manufacture rests; while by aid of his great inventions the markets of Europe have been brought into instantaneous communication with Great Britain. All that Cort did was done, moreover, by means of native materials which were useless up to this time, and by the exclusive exercise of native labour.

It is stated that the design for the floating batteries intended to be used by the French on the Lago di Garda originated in England.

THE CASE OF HENRY CORT,
AND
HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

No. IX.

It can create no surprise that Cort's works at Fontley should have so soon acquired great notoriety, and be visited by the representatives or agents of most of the principal iron masters. Richard Crawshay and James Cockshutt had visited, in 1787, "the little mill at Fontley," as the former designated it in a letter to Lord Sheffield's secretary. At that time Crawshay was not forging more than ten tons per week at his Welsh works; he was too shrewd a character not to appreciate the labours of Cort, or to undervalue such a rival. He forthwith engaged with Cort for the erection of puddling furnaces and grooved rollers at Cyfartha, which were completed by his resident partner, James Cockshutt, under Cort's superintendence. The Cyfartha new mill (as stated upon the authority of Mr. R. Thompson) turned out 200 tons weekly of excellent bars with the same labour previously engaged in shingling and stamping out with the hammer the (according to our present ideas) insignificant amount of 10 tons weekly. Mr. Samuel Homfray, at the neighbouring works of Pandarran, was equally alive to the importance of, and not slow to appreciate, Cort's inventions; and, according to the statement in a letter from Mr. Cockshutt, borrowed of him the drawings of the puddling furnaces, the patterns of the rolls, and Cort's workmen for instruction in the operations; and contracts were signed for the payment to Cort of 10s. per ton of bar iron, as the licence due or royalty under his two patents.

The following letters, or portions of letters, which have been preserved, will be read with interest as contemporaneous accounts of, or throwing light on, the preceding:—

Kitley, 25th of 2nd month, Feb., 1789.

"Respected friend, Henry Cort,—We are duly favoured with thine of the 19th inst., and in reply we are not quite so forward with our rolls as we expected by this time we should have been. It is our intention to have only one pair, and we have eight grooves in them beginning with a 3-in. one nearly round, and going less to a ¾ square. We have one welding furnace nearly ready, and it will give us pleasure if you can spare the man who has been used to the business to put ours in a way. It will give us additional pleasure if thou soon recovers from thy indisposition so as to be able to come up and see us make the first trial, and we are in the meantime,

(Signed) "William Reynolds & Co."

"Cyfartha, April 5th, 1789.

"Dear Sir,—I have delayed answering your last favour of the 8th past longer than I intended that I might advise you of the cargo of blooms and pig iron sent to Gosport, of which at foot you shall have an account. Since I have had any intercourse or exchange of letters with you we have made many careful trials with a stream of cold, after P. Onion's plan, in all of which T. Gales has been the principal workman. We have tried both Plymouth and Cyfartha metal, also sand-iron bottoms, both with and without blast, to which not only myself but my two colleagues also attended, that their opinion might be added in a joint report upon the business to our friend Mr. Crawshay; and it is our opinion that no kind of change is produced from the use of cold air, as used by P. Onions. It does not bear the hammer better; it is not better in colour or texture; nor, in our opinion, is it to be distinguished by any of those circumstances whether or no the cold air has been used. The iron bottoms occasioned such labour to the workmen that we could not continue them; but we found no advantage in doing, and P. Onions has been obliged to discontinue them, at least he covers them over with sand. Mr. Tait, some time ago, having much commended Peter's iron, I asked permission of Mr. Lewis to send down T. Cook. I had never seen but one heat worked, and I thought it probable they might have improved: but T. C. returned disappointed, and says they do not work near so well as we do. In return for this liberty, one of Mr. Lewis's men (Daniel Onions) was sent up immediately after to see what we were doing. He first saw a heat 2½ cwt. weighed to Theodo. He attended the working; he saw one of the balls drawn out, and took a bit of the iron with him; it was all tough, and I think of a brighter colour than any I had seen. The yield was 20 lbs. blooms from 26 cwt. 1 qr. 21 lbs. He told me we beat them much in every respect, but told James Burch we made better dispatch and yield, but fell short of them in quality; and this they continue to give out. Our neighbour J. H. having determined to work under your patent entitled him to our best assistance. We first gave him the dimensions for his furnace, and let him have a man to built it; and we also spared him Thomas Gates for work, as I would much rather see the general success of the scheme than aim at any little exultation over him. The iron he makes draws and looks very well, and he allows himself that it draws sounder than their own, which is really true of so much as I have seen of it. But he has lately received but an unfavourable account of a small quantity which he sent into the north, of which his father complains that it will not bear slitting, but falls to pieces, and even that those rods which do not break he can shake it to pieces; yet he says the iron works well under the nailors' hammer, and makes handsome nails. You have had abundant trials of our iron; that which I saw slit at Fontley showed no inclination to fall to pieces, nor have I heard such a complaint from you. What S. Homfray may do now he has taken upon him the management, in the place of his brother, I cannot say; whether he will pursue the plan, or whether if he does, he will submit to his brother's proposals to you; he has often said otherwise. We have lately drawn out a quantity of your iron in which we find a good deal of vanity, though the blooms look equally well; but I am convinced it is by rolling the toughness is to be acquired, and your iron is particularly adapted for that purpose.

"The substance of my information to Mr. Gibbins respecting yield, &c., was that 30 lbs. of pigs would produce 22 lbs. of blooms, upon which I was inclined to believe something more than 20 lb. of bars would be made; but we had had little experience in drawing out, and would not speak certainly upon that subject; we had also made blooms with little more than the weight of metal in coals used, taking a furnace ready for charging; but this was with greater care than could always be used, and, therefore, a larger quantity must be allowed.

"Furnace building, 1s. 9d., including bricks; making and slinging blooms, 20s. per 22 lbs. This letter was dated January, '88, since then I have not heard from them, but I believe Mr. Crawshay had, by whom you will have been informed what passed from our late experience in drawing. We find it requires more than 22 lb. of blooms to a ton. of bars. I am desired to send a ton of our bars made after your process to Stourton, which I am inclined to do.

(Signed) "James Cockshutt."

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"Plymouth blooms are marked with two strokes of white lead; Cyfartha with one; Plymouth pigs without any mark; the Cyfartha has one stroke of white lead; other particulars you have heard from H. Charles."

On the 11th of March, 1789, Messrs. J. Homfray and Co., of Pendarran, write as follows:—

"DEAR SIR,—Am much obliged for yours of the 19th of February, and the other side send you an account of our performance." The letter, which is mutilated and imperfect, contains the following passage:—"So satisfied myself about it that I shall provide no more blast than is necessary for a blowing a furnace in a new concern I am about establishing upon these mountains, supposing all blast in future as unnecessary in manufacturing bar iron. The new forge at Cyfartha, upon your plan, is a noble thing, and does great credit to those gentlemen there; they are driving it forward with great spirit, and will constantly turn out about 30 tons a week of blooms; they are now drawing some for London. Your rolling mills, not only for these blooms, but for all * * * makes them beautiful iron. I have been to Bristol since, but could not meet with M. Trueman Harford to hear his opinion, but found from the iron weigher that 15 cwt. of it had been sold; and one smith had told him that it worked very well, and punched famously; this we find to be the case in our own shops. The Port iron will be slit at Stourton, and worked under my father and brothers Sam. and Tom's own eye, who are both very anxious for its well-doing, and impatient for its trial. I have no doubt * * Mr. Cockshutt desires to join me in remembrance."

"February 21, 1789. Pigs del patent furnace 3 tons 13 cwt. 3 qr. 7lb produced blooms, 2 tons 8 cwt. 1 qr. 29 lb.; bars, 2 tons. 1 cwt. 1 qr. 20 lb.

"Takes 1 ton 10 cwt. 1 qr. 23 lb. pigs to make 20 cwt. blooms, and 1 ton 15 cwt. 2 qr. 17 lb. pigs to 20 cwt. bars.

"Chaffery takes 1 ton 3 cwt. 1 qr. 19 lb. blooms to make 20 cwt. bars.

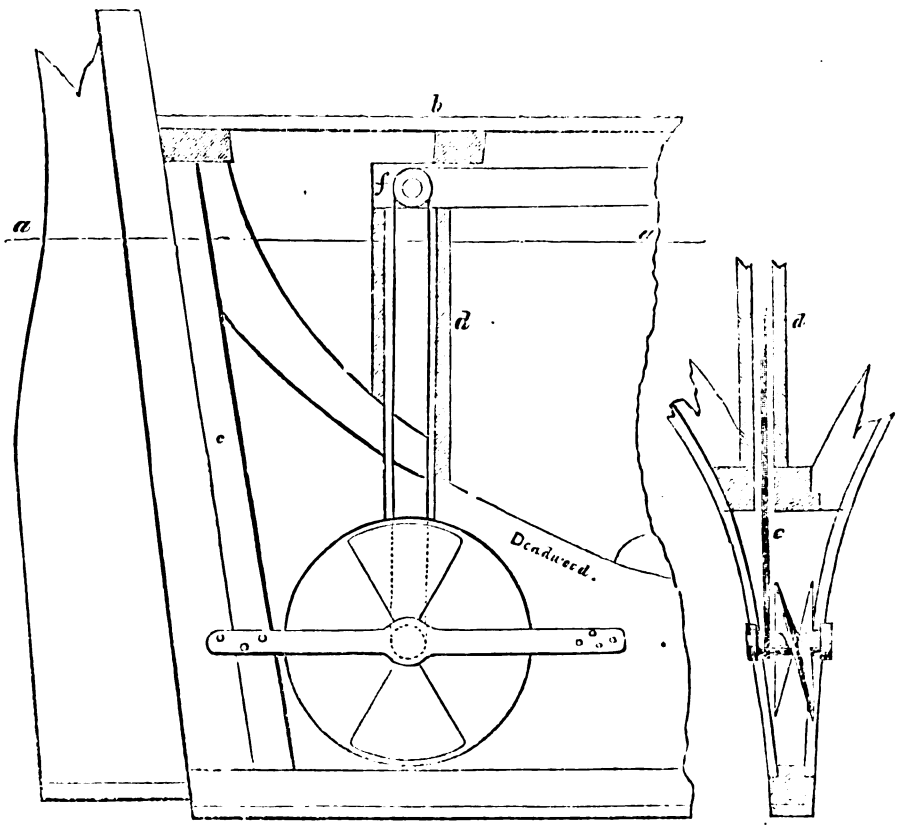
"Coals used in the furnace, 6 tons 12 cwt.

The judgment of the most competent persons was unanimous in favour of the merits of Cort's invention; the trials in the public Dockyards,—the condition of the Navy Board requiring the use of Cort's iron only, were conclusive as to the success of the process. The acts and opinions of the individual ironmasters, could leave no doubt as to the enormous value of the new processes; they took or entered into contracts for licences upon terms freely and liberally conceded on both sides; they expended large amounts of capital for the erection of works, which in a few years would have produced bar iron sufficient to yield ample remuneration to Cort, and a princely fortune for his thirteen children. Cort and his results stand unparalleled in the history of invention and inventions as a case in which the merit of the invention should be universally conceded almost immediately after its announcement, and the rights of the inventor should be so universally acquiesced in by the trade, some of whom were the owners of or interested in prior inventions.

The sequel will disclose a case unparalleled both as regards the character of the transactions and the consequences to the individual concerned.

The Mersey, 40, screw, Capt. Caldwell, C.B., will shortly make a trial of her altered screw, at the measured mile in Stokes-bay; the leading corner of each blade of the screw having been cut off, in consequence of the results obtained from the late experimental trials of the Doris, as affecting the ship's vibration.

WHAT IS TO BE DONE WITH OUR SAILING SHIPS OF WAR?



TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

London, August 17, 1859.

GENTLEMEN.—My mind has been occupied for some time with the consideration of a mode of rendering our sailing ships effective as ships of war; but as the subject involves questions which can only be satisfactorily answered by seamen, I request the favour of the publication of the following thoughts concerning it, in the hope that some of the many naval gentlemen who appear to take an interest in a mechanical journal will endeavour to throw light upon it. Omitting those sailing ships now in process of conversion, those which have been appropriated as depots of various kinds, and all whose age exceeds forty years, we have still a fleet of at least 80 line-of-battle ships and frigates which have not yet reached the age of decrepitude. Their ages, reckoning from the dates of launching, are as follows:—Seven line-of-battle ships of from ten to twenty years; three between twenty and thirty years, and twelve between thirty and forty years. Of frigates carrying between 40 and 50 guns, thirteen of from ten to twenty years, seven between twenty and thirty years, and twenty-two between thirty and forty years, and of smaller frigates, nine of from ten to twenty years, and eight between twenty and thirty years. How many of these may be the victims of premature decay I know not, but that age alone has not incapacitated them for service, supposing them to have undergone the ordinary periodical repairs, will appear from the consideration, that of the ships whose soundness of constitution has justified their conversion into steam ships, the Nelson is 45 years of age; the Neptune 27; the Royal William, the Waterloo, and the Rodney 26. Supposing, then, that the majority of these ships are too old, as they certainly are, to justify the expenditure of large sums in lengthening them to receive engines, and are yet in sufficiently good condition with moderate repair to take the sea as sailing ships, I propose to inquire whether they could, under the altered circumstances of naval warfare, be made efficient fighting ships without the aid of steam power.

It is pretty generally acknowledged, that so long as a screw steam-ship has the power of lying at pleasure across the bows or the stern of a sailing ship, and sweeping the whole length of her decks with a broadside, the sailing ship must be overmatched, although greatly superior in strength to her adversary. And I do not doubt that in the event of war with a maritime power, all the sailing ships now on Foreign Service would be on this account instantly recalled.

This disadvantage would be completely removed if the sailing ships possessed the means of turning or changing their positions without the aid of the sails or rudder; and I do not see that in other respects they would be much inferior to converted ships.

Let us suppose a 90-gun ship to be lengthened to receive engines of 450 or 500 horse power at a cost of £50,000 or £60,000. It would seem, judging from ships like the Algiers and Hannibal, that we could not expect to get more than nine knots per hour out of her. In the "Nile" engines of 500 horse power do not give seven knots. Now, it is difficult to see what advantage such a ship would possess in a contest with the Shannon, say, of 50 guns, and having a speed of nearly twelve knots per hour, which she would not have possessed had she remained a sailing ship, and been fitted with the means of changing her position which I have suggested. Her conversion has only made her far more vulnerable; her engines, her screw, and her weak rudder-post are all vital points, and are all exposed to fire. Her screw is, moreover, constantly liable to be fouled by the wreck of her own spars, or of those of an enemy. It cannot be doubted that there are some circumstances, especially those connected with the evolutions of a fleet, under which the steam power would be very valuable, but we cannot doubt, on the other hand, that the vulnerability I have pointed out deserves serious consideration—far more serious consideration, I believe, than it is likely to receive until we have learned the bitter lessons of experience.

I am not desirous of proving that the sailing

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ship may be made superior to the slow and vulnerable screw ship for war purposes, but I am most certainly of opinion that these sailing ships of ours may be made available for service on foreign stations, so to avoid the great expense connected with the constant use of auxiliary steam-power, and to augment the fleet for home defence by those steam-ships which are now wasting their 60 or 70 tons of coal per day in doing what could be as well done by sailing ships. There would be this advantage, too, in the plan proposed, viz., that nearly every ship fitted in this way would be clear gain in comparing our strength with that of France, as she has but few sailing ships left.

I have stated all this with hesitation because I do not feel competent to decide upon the questions involved: but this I say confidently, that if the possession of the means of turning without the aid of rudder or sails would do what I have supposed, it may be cheaply and quickly obtained. Nothing more is necessary than to cut a hole in the deadwood to receive a screw capable of motion in a vertical longitudinal plane by means of manual or other power on board. The amount of power required may be readily ascertained by comparison with the rudder. A ship would have good steerage way with a speed of six knots; in other words, a rudder moving through the water at this speed would certainly encounter sufficient resistance to turn the ship. But as the rudder is never inclined at a greater angle than 30° to the line of the keel, the normal or effective velocity of the water on the rudder would only be three knots. If, therefore, a screw of sufficient size is made to revolve fast enough to give a velocity in advance of three knots, it is likely to do more towards turning the ship than a rudder hard over, because the thrust is more direct. Now, a screw ten feet in diameter, two feet long, and with twelve feet pitch, could be easily fitted in a frigate without weakening her or diminishing her stowage. Such a screw would, with twenty-five revolutions per minute, move through the water in advance with a velocity of three knots per hour. The indicated horse-power corresponding to this would be, if the screw were under the same circumstances as the propelling screws, about 7½. It may, therefore, be fairly assumed that nine or ten horse-power, applied by means of capstans, or if it were thought desirable, by a small donkey-engine, would be sufficient to turn a 50-gun frigate as rapidly as she would be turned by her rudder with a steerage way of six knots. Such a screw would be ten or twelve feet below the water, and entirely within the ship, so as to offer little resistance to motion. In the section which accompanies this letter the screw is shown in the horizontal position, which, being that of least resistance, would always be assumed when the vessel was in motion, supposing the screw to be allowed to move freely. The only resistance of any consequence caused by the introduction of the apparatus would then be the negative and positive pressures at the fore and after ends of the aperture. These might be reduced if it were found desirable by hanging slight metal shutters over the upper portion of the aperture. Some of your readers may remember that a proposition was made some fifteen years ago by a Mr. Foulerton, master mariner, to fit all kinds of sailing and screw ships with an apparatus of this kind to assist the vessel in stays, and to enable her to manœuvre after the loss of the rudder. It was entertained by the Admiralty, and a screw was fitted by Mr. Foulerton in the St. Lawrence frigate. As it was only 3 feet 6 in. in diameter it failed, as might have been expected. All the reasons for its adoption urged by him upon the Admiralty still exist, and with the special one I have here endeavoured to point out.

I am, Gentlemen, your obedient servant,

A Naval Architect.

REFERENCES TO ENGRAVING ON OPPOSITE PAGE.

Elevation and Section of the after part of the 84-gun sailing ships, showing the proposed mode of fitting a 10-feet steering screw. *a*, Load water-line; *b*, Orlop deck; *c*, Inner stern-post; *d*, Watertight trunk; *e*, An endless band passing up the trunk to an axle, *f*, which is turned by manual or other power.

BOYDELL'S TRACTION ENGINE.

During last week the capabilities of this admirable road locomotive were publicly tested in Hyde Park previous to the engine and its train of waggons being despatched to Bombay, in accordance with the wish of the Secretary of State for India. The engine is perfectly under control, even for the sharpest turnings of ordinary streets, and easy both in ascent and descent of steep inclines. This endless rail acted with the most perfect satisfaction, quite bearing out what has been before stated, that the engine could not only travel over the worst roads, but that the roadway itself is actually improved by the equal and broad compression of the rails. The engine can with ease draw from 60 to 70 tons along ordinary turnpike roads at the rate of four miles per hour. Attached to the machine were five powerful waggons specially made for the purpose by Creskill, and all of which, by removing a pin or pivot from between the two leading wheels, are enabled to follow every turn of the engine, with a serpent-like movement, which gives the utmost freedom and flexibility to the whole convoy. More than once the whole train turned in less than half its length, and that, too, in passing over grass and uneven ground. The indentation made by the passage of the wheels was certainly no more than would have been made by an ordinary coal waggon. 160 soldiers of the Guards were in attendance and rode in the waggons, and with this load the whole train was taken easily across the level parts of the Park at the rate of six miles an hour. The result of the trials were in the highest degree satisfactory, and seems to leave no doubt whatever that over the rough roads of India during the summer season, when the rivers are dry, the engines will be of the utmost service in facilitating the transmission of merchandise. For military purposes, such as getting up guns and siege stores, an engine of the kind would prove an invaluable auxiliary. Two have been ordered for the Pasha of Egypt for the purpose of traversing the deserts with caravans, and before long doubtless many more will be sent to India.

JENSEN'S MARINE ENGINE GOVERNOR.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—Will you allow me to offer a few remarks on an invention of Mr. P. Jenson, as described in your columns, for regulating the speed of marine engines during severe gales. The inventor proposes, by means of self-acting machinery, to shut off the steam at the moment the water descends from under the paddles; then to admit it into the engines as soon as the waves arise to their ordinary level. The arrangements, it must be admitted, are very simple, and the principle will probably appear very plausible to many persons. But there is no difficulty in demonstrating that the arrangements proposed would fail to accomplish the object in view. Mr. Jensen has evidently lost sight of the fact that, when engines have attained their full speed, each stroke of the piston becomes independent of the action of the steam; and, consequently, that the shutting off of the steam would not instantaneously diminish the speed of the screw or paddles. The only result that would be obtained by adopting this invention, would be to check the speed of the engines at the moment when great power would be required; that is, when the waves would strike against the paddles, causing a deeper immersion. The steam, it is true, would be admitted at that moment, but this would not increase the speed of the engines until the moment when greater speed would be more than useless; for, by the time the steam would have given a full impetus to the engines, the paddles would, probably, be again whirling in the air. Every engineer who has watched the working of marine engines when sailing over a heavy sea, well knows the inconveniences and dangers of the present arrangements; but it is far easier to see the extent of the evil, than it is to provide an efficient remedy. When the screw and paddles are combined in the same vessel, the evil complained of will be diminished to some extent, provided all the engines are connected. The screw and paddles would act tolerably as governors, somewhat on the same principle as fly-wheels in stationary engines, and I imagine that principle might be adopted in vessels with engines of not less than 800 horse-power, provided the screw shaft could be efficiently connected with the paddle engines. Probably the result would be that a high speed could be maintained while sailing over a heavy sea, with a head wind, without having recourse to an increased consumption of fuel, as at present. If I am wrong in these surmises, probably some of your correspondents will set me right.

I remain, Gentlemen, very respectfully,

John de la Haye.

Perth, August 16th, 1859.

IMPROVED RIFLE FIRE-BRAND.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—The rifle-brand, charged with phosphorous dissolved in bisulphide of carbon, which I lately successfully tested at Chatham, with the sanction of his Royal Highness the Commander-in-Chief and the late Secretary for War, was so constructed that its neck was broken on striking loose hanging canvas, when the liquid spread on the canvas and immediately set it on fire. My present improved brand has a tube of glass charged with the liquid placed within. It is then closed in front with a plug of lead. On firing the rifle the glass tube breaks by the jar of the exploded charge. The liquid is diffused in the interior of the brand, and cannot immediately escape from it; but after a few minutes it will percolate through the sap pores of the wood, and burst into flame. This brand is therefore well adapted for setting fire to long grass, bushes, weeds, &c., that cause no shock to the fall of the brand, and will set fire to the vegetation all around a hostile battery of artillery whenever it moves.

I am thus particular in describing its usefulness, because I sometime ago read a speech in the public papers by his Royal Highness the Commander-in-chief, wherein he stated that he should be glad to receive information on military matters from all persons qualified to give it; and also because when I had the honour to attend a Levee at the Horse Guards more than a year ago, His Royal Highness was pleased to say, "We ought to be much obliged to you."

I have found that after using a leaden shell charged with the liquid, when all the liquid appeared to have burned out, on melting the used shell in an iron ladle, a portion of the phosphorous, which remain on the lead in a state of incrustation, continued to burn for some minutes. This proves the extraordinary "vitality of the liquid fire."

J. Norton.

Rochesville, July 30.

P.S.—Colonel Sandham, R.E., commanding at Brompton, Chatham, informed me that a report would be made to the War Department on the result of my practical experiments at Chatham. Several months have now passed, but I have not yet heard of the nature of that report. I am, however, ready to repeat the experiments at any time or place required. J. N.

Some months back Mr. J. Bailey Denton, of Stevenage, published some observations in anticipation of the effects of the drought of last winter in reducing the water supply of the present summer and coming autumn. His anticipations are now, he says, being realized, and many are the villages and wide are the districts in which the inhabitants are suffering from the want of the first essential of health and comfort, and he again calls the attention of our legislators and the larger landed proprietors, who are returning to their estates in the country, to the importance of providing water in the villages of the rural poor. He suggests that means be found to concentrate and preserve the drainage and surface water which runs to waste during the non-evaporating months of winter and spring for use in the summer and autumn in those localities where from soil and height there is no constant supply.

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FREE DRINKING FOUNTAINS.

In our leading columns we have drawn attention to the beneficent work of the Free Drinking Fountains Association. We here propose to show what mechanical arrangements the Association has adopted for the efficient and economical carrying out of its plans. The simplicity of these arrangements (which are shown in the sectional view Fig. 1 of the annexed engravings) are obvious, and call for little remark, if we except the application of *a filtering medium in an air-tight cylinder* in connexion with the main supply pipes of the water companies, by means of which a large amount of pressure will be obtained to force the water through the filtering medium. The construction of this cylinder with a convex bottom permits most of the organic impurities to fall by their own specific gravity, thus reserving for the filtering medium only the action of stopping the more minute organic impurities, with those held in solution. The flushing pipe is always a ready means of cleansing the cylinder cistern. The ball-cock cistern shown is rendered necessary by the requirements of the Water Companies, and will in some measure regulate the pressure. The filtering medium has been prepared upon principles approved by the Association. It will be inclosed in, or will itself form, a second cylinder containing animal charcoal, through which the water must pass, previously passing in the one case first through a porous and charcoal stone imported from abroad, and suggested by Mr. Jackson, the Secretary of the Association, and in the other case, first through a filtering substance manufactured expressly for Messrs. Wills, of 12 Euston Road. These filters for the present will be applied inside the air-tight cylinders, and the result it is hoped will support the strong opinions expressed of their efficiency. The cylinder-cistern may be applied to either Standard or Mural Fountains, or in case their structure will not admit of insertion, the same arrangements can be made underground.

The Association having engaged to erect a drinking fountain in the Crystal Palace grounds, the company selected the design. This fountain, shown at Fig. 2 (by Messrs. Wills, Bros.), which we have had carefully engraved, can be constructed of bronze or bronzed iron, and the vase may either be of the same materials or of marble. This design, although occupying but the smallest space with the greatest strength, will allow of nine persons drinking at one time.

The water supply for drinking fountains will, it

FIG. 1.—INTERNAL VIEW.

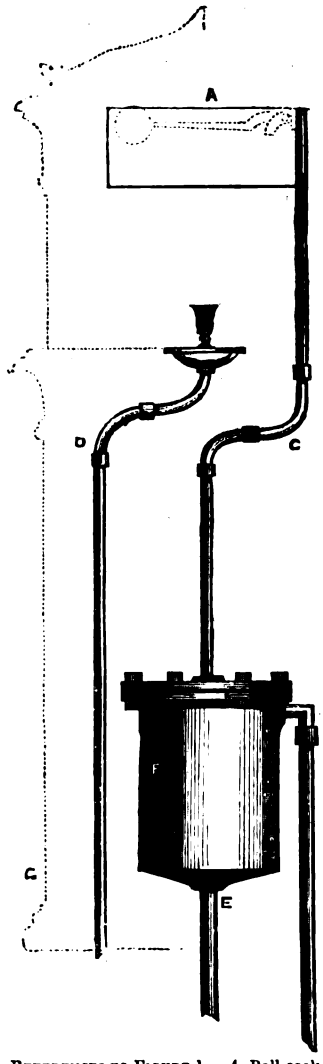

FIG. 2.—CRYSTAL PALACE FOUNTAIN.

REFERENCES TO FIGURE 1.—*A*, Ball cock cistern, inflexibly required by the London Water Companies; *B*, The supply pipe; *C*, The pipe conducting filtered water to the ball cock cistern; *D*, The waste pipe conveying the water to a dogtrough, thence into a sewer; *E*, Pipe for flushing and cleansing cistern; *F*, Cistern containing the filtering medium; *G*, Outline of design.

FIG. 4.—FREE DRINKING FOUNTAIN AND CATTLE TROUGH AT LIVERPOOL.

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Fig. 3.—Drinking Fountain of the New River Company.

is hoped, be provided by the liberality of the water companies, as *three* have already consented to do; but until a memorial, which the Association has now prepared to be sent to the general companies be answered, no exact statement as to terms can be made.

The following list of sites may be acceptable as showing the number of fountains which the Association has erected, or is now under engagements to erect, having in four months from the inauguration received through the donations of private persons and contributions from the local authorities, the funds and the control over sites necessary for this encouraging commencement of the great work proposed, viz., to erect not less than four hundred fountains in the metropolis:—

1. Fountain at Snow-hill, Mr. Gurney.
2. Emerson-street, Bankside,
3. Upper Ground-street,
4. Triangle, Union-street, Borough, } Five in connection with St. Saviour's, Southwark.
5. Rowland Hill's Chapel,
6.
7. Islington-green,
8. Holloway-road,
9. Lower-road, } Five with St. Mary's, Islington (one opened last week).
10. Liverpool-road,
11. Caledonian-road,
12. Regent's-circus, Oxford-street, Mr. Gurney.
13. Bethnal-green, in front of St. John's Church, with Mr. Link (now opened).
14. Marylebone Workhouse wall, with a lady (ready for opening).
15. Stepney, with Rev. J. Kennedy.
16. Bermondsey, Mill-lane, with vestry (nearly ready).
17. Victoria-gate,
18. Pickering-place,
19. Adelaide-place, Regent's-canal, } With Paddington Vestry.
20. Paddington-green,
21. Sloane-square } With Chelsea Vestry.
22. Near Pier
23. Peter-street,
24. Broad-street, } With St. James's, Westminster.
25. Great Marlborough-street,
26.
27. Tower-hill, opposite Mint, with Whitechapel Board of Works.
28. Newington-causeway, with Mr. Dunn.
29. Adelaide-place, London-bridge, with Provident Institution.
30. Endell-street, with Mr. Langdale (now open).
31. Victoria-road, near Palace-gardens.
32. Strand, with Mr. Hanbury, M.P.
33. Mother Red Cap,
34. Junction-road, Kentish-town,
35. Southampton-arms,
36. Brighton-street, corner of Cromer-street,
37. Euston-square,
38. Tottenham-court-road,
39. The Brill, Somers-town,
40. York and Albany,
41. Pancras-vale,
42. Brecknock-arms, Camden-town,
43. Goldington-crescent,
44. Gray's-inn Hospital,
45. Hampstead-road.
46. Cumberland-market, } With St. Pancras Vestry and private persons.
47. Horseferry-road, Westminster, Mr. Stafford.
48. Westminster-bridge-road.
49.
50. } With Mile-end, Old-town, Vestry.
51.
52.
53. Cannon-street-road, } With St. George-in-the-East.
54. Chigwell-hill,
55. Highgate-hill, } With Committee at Highgate.
56.
57.

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58. At the Royal Exchange, Metropolitan Drinking Fountain Association.
59. Waterloo-road.
60. In railings of St. Saviour's Church, Southwark.
61. In Tooley-street.
62. Near Marble Arch, with Baron de Bliss.
63. Rosemary-lane, with Miss Barber.
64. Near railway station, Putney.
65. Near Arsenal gates, Woolwich.
66. Landing-pier, Lambeth, Rev. J. Lingham.
67. New-cut, Lambeth, with Sir M. Peto.
68. Crystal Palace, Sydenham.
69. East India Dock Gates, Poplar (opened last Thursday).
70. Moor-street, St. Giles (with working men).

Several of these will now be opened each week to the public.

The objects which a street drinking fountain should, in the opinion of the Association, attain, and the conditions of their attainment, are as follows:—They are—

1. To yield a small stream of continually flowing pure and cool water, most easily accessible to the greatest number of people.

2. The Metropolitan Fountains Association has decided, in accordance with the opinion of eminent medical officers, to increase the purity of the water by a process of re-filtration, and this must be done in the fountain itself; therefore, each fountain must be so constructed as to contain a filter, which shall be easily accessible at all times.

3. In accordance with the inflexible requirements of water companies, each fountain must be also provided with a ball and cock cistern, as this operates to destroy the force of the water, consequently it must be placed above the point of the water in the cup.

4. The pipes, filter, &c., must be insulated, so as to preserve the water from the extremes of heat in summer and cold in winter.

5. The fountain must occupy the least possible space. The necessity of this consideration is obvious, seeing that most of these fountains are intended to occupy space in the greatest thoroughfares of the metropolis.

6. The upper structure of the fountain should as little as possible intercept the street view.

A number of designs have been submitted to the Association, and from them several have been selected. The best of them were engraved in the *Builder* for August 6, to which we would refer our readers.

By the kindness of Mr. Smithies, the esteemed editor of the *British Workman*, we are ourselves enabled to present in Fig. 3, a new and splendid engraving of the fountain recently erected by the New River Company, prior to its appearance in that publication; and by the favour of the same gentleman, we are also enabled to illustrate the Liverpool fountain, Fig. 4, in conjunction with which a cattle trough and dog trough have likewise been erected as shown. These admirable wood-cuts speak for themselves.

For a statement of the rapid progress which the drinking fountain movement is making in the provinces, we must refer to the various detailed statistics that from time to time have been published.

Literature.

Rifled Ordnance. Fourth edition, revised and enlarged. By Lynall Thomas, F.R.S.L. London: Published by J. Weale, 59 Holborn. 1859.

This volume, in its former editions, in which it was published anonymously, was noticed with some favour in our columns. Its authorship is now acknowledged by Mr. Lynall Thomas, who has of late years had several improved forms of ordnance and projectiles under trial at Shoeburyness with very good results, and who has also carried out numerous experiments on gunnery privately and at his own expense. To the work in its present form—the sub-title of which is "A Practical Treatise on the Application of the Principle of the Rifle to Guns and Mortars of every Calibre"—Mr. Thomas has added a full reprint of the paper contributed by him in December last to the Royal Society, on a New Theory of the Initial Action and Force of Fired Gunpowder, a lengthy abstract of which was published in the Mechanics' Magazine for June 3rd, page 360.

The subject discussed in this volume is a modern one, and has not hitherto gained much attention from authors competent to treat of it accurately. The great merit of Mr. Thomas's treatise is due to the fact that he has not confined himself to mere theoretical inquiries, but has taken considerable pains, first to ascertain facts experimentally, and then to elucidate them by reference to mathematical considerations. The order in which he proceeds is as follows:—1, general remarks on rifled cannon and projectiles; 2, the turn of the rifling; 3, the influence which the *size* of the projectile has upon the turn; 4, rifled projectiles; 5, the grooves and increasing spiral; 6, the comparative advantages attending the employment of rifled and smooth-bored guns; 7, the range of elongated projectiles; 8, experiments in gunnery; 9, the nature and action of fired gunpowder. As an original and valuable treatise on a very important subject, we warmly recommend the volume, although we cannot undertake to assent to all the principles laid down in it.

The following extract from the preface will serve to illustrate both the style and the capabilities of the author:—

"My attention has recently been directed to a statement made by Sir W. Armstrong at the United Service Institution, and reported in the Mechanics' Magazine for June 3rd of this year, to the effect that elongated projectiles have a greater range when they are fired in the air, than they would have if they were fired in a vacuum, or non-resisting medium. This statement bears at first sight so much resemblance to certain opinions which I have hazarded myself, that I take the opportunity afforded by a preface to make those observations with reference to it, which I was precluded doing in the proper place, from the circumstance of the sheets being already in the press. Sir W. Armstrong's remarks (as reported) are as follows:—'In a vacuum the trajectory would be the same whether the projectile were elongated or spherical, so long as the angle of elevation and the initial velocity were constant; but the presence of a resisting atmosphere makes this remarkable difference, that while it greatly shortens the range of the round shot, it actually prolongs that of the elongated projectile, provided the angle of elevation do not exceed a certain limit, which in my experiments I have found to be 6°. This appears at first very paradoxical, but it may be easily explained. The elongated shot, if properly formed, and having a sufficient rotation, retains the same inclination to the horizontal plane throughout its flight, and consequently acquires a continually-increasing obliquity to the curve of its flight. Now the effect of this obliquity is, that the projectile is in a measure sustained upon the air, just as a kite is supported by the current of air meeting the inclined surface, and the result is, that its descent is retarded, so that it has time to reach to a greater distance.' The above remark that the air 'actually prolongs the flight of elongated projectiles,' requires to be considerably qualified. This effect may perhaps be produced under certain circumstances, as, for instance, when the weight or the length of the projectile is great in a certain proportion to its diametral surface, when the *velocity* is limited, and other circumstances, which I shall allude to directly. Although Sir W. Armstrong may have remarked this peculiar effect in his 32 lb. or 18 lb. elongated projectiles (in the same manner as I noticed it myself with a 32 lb. projectile of three diameters in length) I should hardly think that he had observed it in the case of elongated projectiles of smaller diameter, unless they were fired with a lower velocity than usual. In the chapter 'On the Range of Elongated Projectiles,' the reader will observe that I have not gone quite so far as to assert that long projectiles actually have their range prolonged when fired in the air; I have merely hazarded the conjecture that, under certain circumstances, such might possibly be the case. It cannot be positively asserted as a fact, until we know precisely what initial velocities these projectiles really acquire. I suppose that it might be true, from the circumstance of finding that the ranges of long projectiles of a certain size and form, varied in a greater degree (with the elevation) than they would do in a vacuum. The full explanation of the manner in which the resistance of the air tends to lengthen the flight of a long projectile, may be seen as follows:—When a round projectile is passing through the air, the whole resistance to its flight* is in the direction of the tangent to the curve; but when a long projectile is used, a different result is obtained. For, in consequence of the well-known laws of hydrodynamics, that when a solid body strikes obliquely on a fluid mass, the resistance will be perpendicular to the surface of the solid, the resistance on the surface of an elongated shot will no longer act in the direction of the tangent to the curve of flight; but the resultant of the pressures on the fore end and the under side will act in a direction *above* the tangent to the curve, so that although the velocity of the projectile is diminished, it will be made to describe a path rather less curved to the horizon than it would otherwise have done. Hence in certain circumstances, as when the elevation of the gun is not very great, the range may be prolonged. It will be noticed that Sir W. Armstrong considers that to be a properly formed shot of which the axis remains parallel to itself during its flight; but I am convinced it will be found that a preferable form of shot will be one that has the centre of gravity thrown forward, so that the shot will remain approximately a tangent to its trajectory throughout its flight. In this case the loss of velocity will be much less than in the former, and at the same time the obliquity to the trajectory will be sufficient to call into play the sustaining power of the air. A projectile which maintains its axis parallel to itself might have a certain advantage when the gun has little or *no* elevation, because the obliquity to the curve of flight would not then be so prejudicial to the velocity of the projectile, and the whole of the pressure upon its under surface would tend to sustain its flight; but the time of flight, in this case (unless the gun were placed on an eminence), would be too small to admit of any great advantage being thus obtained. When, however, the angle of elevation is high, the increasing obliquity to the curve of flight tends to diminish the velocity more than to retard the descent of such a projectile; and its curve of flight and range are, in consequence, diminished. Hence the effect which Sir W. Armstrong remarked in his experiments; that the prolongation of flight alluded to was only observable when the angle of elevation was below 6°. Sir W. Armstrong's concluding sentence, that 'its (the projectiles) descent is retarded, so that it has *time* to reach to a greater distance,' could hardly, I should think, have been carefully considered before it was uttered; for every person familiar with the theory of the motion of projectiles will see that by diminishing the velocity of a projectile after it has passed the apex of its curve, its time of flight is lengthened, whilst its range is, on the contrary, diminished. Further experiments will be required for ascertaining whether the forward position of the centre of gravity conduces as much to precision as to great range. Of the latter there can be no doubt; and I believe it will be found that, at the higher elevations, projectiles constructed in this

* This is independent of the unequal action of the air on opposite sides of the shot, caused by its rotary motion!

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manner will achieve both greater range and greater accuracy than any other.*"

The author of this volume has been fortunate enough to be present, with the consent of Sir W. Armstrong, at several trials of the Armstrong gun at Shoeburyness. Like ourselves he is not disposed to view that weapon with unqualified approbation, or to consider it by any means a final success in the art of gun manufacture. That it has excellent qualities neither he nor we deny; but that it is better suited for the wear and tear of actual warfare than all others we are not by any means prepared to admit. As the subject is of the utmost importance we extract the following remarks from Mr. Thomas's pages on this weapon:—

THE ARMSTRONG GUN.

"The great merit of the Armstrong gun appears to consist in an admirable combination of certain approved principles rather than in the adaptation (except, perhaps, with regard to the manufacture of the gun) of any positively new invention. So happy a combination, however, could only result from numerous experiments conducted by a person possessing great mechanical skill, and a considerable knowledge of the science of gunnery. The chief noticeable points in which this gun differs from those in ordinary use, are the metal of which it is constructed, and the (breech-loading) principle upon which it acts. With regard to the first of these points the success of the Armstrong gun has placed beyond a doubt the fact that wrought-iron and steel are admirably adapted for the construction of rifled field-pieces and guns of a medium size. This, in itself, is an important fact. But as gun-metal is also well adapted for field-pieces, the question whether it would be advisable to construct the smaller kind of guns of the above metals will depend very much upon the time and expense which must necessarily be employed in their construction, but should the construction of guns capable of throwing elongated shells, of a weight equal to that of the heaviest shot now in use, and upwards, be attended, as it probably will, with the same successful results, the employment of these metals—at least for *large rifled cannon*—will be imperative. The *breech-loading* principle has, I think, but few points to be remarked in its favour, compared with what may be urged against it. In this case, however, the combination by which the efficiency of the projectile is obtained is dependent entirely upon it. The great accuracy and range obtained with the Armstrong gun are startling from their novelty only; for as yet the rifled cannon is but in its infancy; and although the greatest possible praise is due to Sir W. Armstrong for the great ingenuity, as well as for the superior mechanical and scientific knowledge which he has displayed in the construction both of his gun and his projectiles, I am nevertheless fully persuaded that equally good results will be obtained with a combination of a much more simple and inexpensive character. The expenditure of time and labour which would be necessary to keep a large number of breech-loading guns continually in a fit state for service, both when stored and in use, must prove a great obstacle to their general employment. Their general efficiency in action also has yet to be tested. An additional obstacle presents itself in the fact that these guns would be very difficult to procure in a sufficient quantity on an emergency. The constant improvements which are likely to be made in breech-loading pieces should also render us cautious about adopting any one method in particular until its superiority has been thoroughly established in actual service. Breech-loading guns, unless of the simplest construction, must always be objectionable in action. It may be an easy matter enough for well-trained men, under the immediate superintendence of a number of scientific officers at Shoeburyness, to fire so many rounds a minute; but would this be so in action? A system of breech-loading, which a man of common capacity cannot learn and retain after ten minutes' teaching, and one which causes the employment of *detached pieces* of metal; any, in fact, which requires more than two simple movements, one to open and one to close the chamber, is open to objection. If it is considered necessary to employ breech-loading pieces, they ought to be made to act with a movement which a man can perform mechanically, as a soldier loads his musket or a sportsman his gun, without having to think over it. Great care must be taken, with guns upon this principle, that no escape of gas is allowed; otherwise, the men between decks in a ship, or in a casemated battery, would be stifled in working them; not to speak of the loss of power occasioned by it. Regarding the Armstrong gun as a scientific engine or machine for the projection of an elongated shot, it is a *chef-d'œuvre;* the accuracy obtained with it is remarkable. This is partly due to the delicacy of the *sights* (which are so arranged as to allow for the lateral deflection), and to the absence of all recoil. If the maximum results attainable with rifled cannon depended entirely upon the combination employed in this case, we might safely assume that no other nation could produce a weapon to surpass it; it would, however, be presumptuous to assert this—in fact, both at home and abroad, results nearly approaching, if not equal to it, have been already obtained by much simpler means; and if a hostile nation could produce half-a-dozen guns to our one, it would be a matter for serious consideration whether it would be to our advantage to employ guns constructed on this principle or not. As it is, other nations are already fully equipped with rifled cannon, whilst we possess some dozen experimental guns only. Even allowing that the rifled cannon of foreign nations are not equal to the two or three specimens of the Armstrong gun which we possess, we are by no means certain that they are not better adapted to the purposes of war. So much has yet to be learned respecting rifled cannon that no one can assert, at present, that the Armstrong gun—untried as it is—is really the best suited in every respect for actual warfare. Moreover, if we confine ourselves to guns constructed upon this principle, we can only have two hundred of them at the end of a year. But supposing that in six months' time we are engaged in a great European war; and supposing, further, that the Armstrong gun be found in actual service to fail in achieving all that has been anticipated from it, what are we then to do for rifled cannon? Surely some such method as that which I have suggested might be adopted, in order by utilizing the principle of the rifle to place us at once on an equal footing with other nations, without prejudice to our finally adopting that description of gun which is found by experience to be the most suitable for practical purposes, whether it be the Armstrong or any other. Perfect accuracy is, no doubt, highly desirable; but there are so many circumstances which must arise, in actual warfare, to preclude the possibility (except under very peculiar circumstances) of its attainment, that it is extremely questionable whether it is worth while sacrificing other important objects in attempting to acquire it. A difference of a few feet in the deflection, in a range of a couple of thousand yards or so, cannot surely be of so much importance as to have a gun of simple construction and easily worked."

We should be doing very imperfect justice to the author if we failed to state that his work is much more than a medium for recommending a particular form of gun and projectile of his own invention. He does recommend improvements of his own, it is true; but these are by no means the staple material of the volume. It may with fairness be described as an essay towards a discussion of the nature of rifled cannon generally, and the principles involved in their construction, together with an endeavour to urge the Government to undertake a full and scientific inquiry into this much neglected subject. In working out these great objects the author communicates much original and valuable information, but he never loses sight of the fact that no work can at present be more than an essay, or an attempt to *approach* the truth of the matter. Viewed in this light, his work is a very praiseworthy and instructive one, and no student of gunnery or gun-construction, whatever his knowledge or experience may be, should think of leaving it unstudied.

Wool and Woollen Manufactures of Great Britain: a Historical Sketch of Rise, Progress, and Present Position. SAMUEL BROTHERS. 1859. London: Piper, Stephenson, and Spence, 23 Paternoster-row.

THIS book is printed on such very superior paper, and in all but authorship has been got up with such disregard of expense, that it is a pity "Samuel Brothers," of 29 Ludgate-hill, and of "Sydenham Trousers" notoriety, did not take the pains to have it edited with some little show of care. A little money spent in that manner would have helped to make it more valuable in its way than it can possibly prove in its present form. This Historical Sketch is to be followed by other volumes on "The Natural History of Wool," and on "The Mechanical History of Woollen Manufacture." We hope these will be edited by some one who knows when he has written intelligible English and when he has not—which is more than the editor of the volume before us knows. It consists, nevertheless, of an historical narrative, the reading of which would add much to the knowledge of many.

MAJOR RHODES' TENTS.

THE board of medical officers appointed by the Duke of Cambridge to report on the hospital tent which has been invented by Major Rhodes—one of which has been for some time in use in the grounds attached to the garrison hospital at Chatham—having made a very favourable report of the invention, the Commander-in-Chief gave directions for another description of Major Rhodes' tent, called the "Field hospital tent," to be pitched there. Major Rhodes accordingly arrived at Chatham on Saturday afternoon last, for the purpose of superintending the erection of this field tent, which, like the others invented by him, is of simple construction. "The ground having been accordingly selected, the tent was pitched," says the *Times'* correspondent, "by four men in a comparatively short space of time, notwithstanding that three of the men who assisted knew nothing whatever of tents, and had probably never seen a military tent pitched in their lives. In this, as in his other tents, Major Rhodes entirely discards the use of the clumsy and inconvenient tent-pole, the coverings being supported on pliable ribs of ashwood, the bottoms of which are fixed into the ground, the tops meeting in a wooden head, which also answers the purpose of a ventilator. The tent erected on Saturday is 20 feet in diameter, and affords ample accommodation for 20 patients, giving each patient a space of 3 feet by 7 feet, leaving a clear central space of

* The results obtained with the shells, noticed at page 9, the centre of gravity being, in their case, in a forward position, were comparatively greater when the elevation was as much as 10°, than those obtained with Armstrong's. And they would have been still greater if I could have had at my disposal (which was far from being the case,) the same mechanical means possessed by Sir W. Armstrong or Mr. Whitworth, for properly carrying the principle into practice. These are the first, and I believe the only projectiles of a proper length which have yet been successfully fired from a rifled cannon which does not load at the breech; and are, therefore, probably, with the exception of Sir W. Armstrong's, the only projectiles with which the object I have been remarking upon could have been obtained. From the high velocity maintained by these projectiles (about 1,000 feet a second), it appears probable that to them a value has hitherto been assigned to the resistance of the air, the *terminal* velocity of these projectiles (according to the ordinary computation) not much exceeding 700 feet a second."

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6 feet diameter for the use of the medical officers and hospital attendants—an advantage which is, of course, out of the question in the present tents, where the pole monopolises the most important part of the interior. But perhaps the most valuable improvement in this tent is the excellent system of ventilation adopted."

Our Weekly Gossip.

WITH respect to the projected coinage of bronze, the thought has arisen in our mind as to whether Britannia as a design for the reverse of them ought not to be sacrificed. For nearly 200 years has that very tall lady been doing duty as a device for the reverse of the copper coinage of these realms, and the question comes whether it is not now time to relieve guard, and dismiss Britannia, her shield and her trident, to the limbo of bygone things. The origin of the design was questionable enough, and it is not needful for us to perpetuate the memory of Charles II., or any of his beauties, one of whom sat for the original Britannia. Britannia, in the literal sense, would doubtless remain ruler of the sea, though her tall representative disappeared for ever from the coinage of the realm. At any rate she does not rule the wave the more safely because that person has sat so long in her helmet looking wistfully out at—nothing. The omission of Britannia and the ledge of rock upon which she, with all her stage properties, is so calmly resting, would make room for a totally new device for the neater pieces of money with which we are shortly to be favoured, and would furnish a field for the trial of skill invited in another column among engravers.

The Science and Art Department of the Committee of Council on Education, have issued the following circular:—"Teachers wishing to attend the examinations of science and art department in—1 practical and descriptive geometry, with mechanical and machine drawing, and building construction; 2, physics; 3, chemistry; 4, geology and mineralogy (applied to mining); 5, natural history,—for the purpose of obtaining augmentation grants to their salaries (under the science minute of the 2nd June, 1859), must send their names, addresses, and present occupation, to the secretary of the department, South Kensington, on or before the 31st October, 1859. The examinations will be held in the Metropolis in the last week of November. Certificates of three grades will be granted in each subject, giving the holder an augmentation grant of 10*l*., 15*l*., or 20*l*. a year on each certificate while giving instruction to a class of operatives in that subject. These payments will be in addition to the value of any certificates of competency for giving primary instruction, should the teacher have already obtained any such from the Committee of Council on Education."

The Atlantic Telegraph Company publish the following letter from Sir Charles Yorke, Military Secretary to the Commander-in-Chief:—"Horse Guards, Aug. 6, Sir,—With reference to my letter of the 8th ult., in answer to your inquiry as to any messages having ever been transmitted to Newfoundland by the Atlantic Telegraph during the time it was in operation last year, I am directed by the General Commanding-in-Chief to acquaint you that replies have been received from the general officers commanding the troops in Canada and Nova Scotia to the effect that a telegram dated London, England, August 31, 1858, respecting the 30th Regiment, was received at Montreal on the 3rd September and answered on the following day, and that a telegram of the same date respecting the 62nd Regiment was received at Halifax on the day of its transmission—namely, the 31st of August, 1858. I have the honour to be, Sir, your Obedient servant, C. YORKE. A. T. Hamilton, Esq., Director of the Atlantic Telegraph Company.

The following may serve a useful purpose, although we cannot ourselves share all the sentiments of the writer:—Gentlemen,—Having had the pleasure of seeing Mr. Clifford's boat-lowering apparatus long before it had obtained popularity, I have watched it with interest ever since, and can bear testimony to some of the uphill work of the inventor. Mr. C. has briefly and mildly answered the shabby allusion of "Nauticus" to "a person of an opposite calling." The narrow-minded feeling from which it emanates, is unfortunately so prevalent that a protest should be occasionally made against it. A father hears of an opening which *he* thinks will suit his son, and, with the very best intentions on his part, places his son in a situation for which he is totally unfit. It soon appears that the son has talents which cannot possibly be made use of in his calling; he is, in fact, "of an opposite calling to what he ought to be," a "square man in a round hole," and whenever he attempts to obtain employment in a sphere in which his talents may be used, the answer is, "Oh, you are of an opposite calling." Now, "Nauticus" maintains by the above sentence that this square man ought not to be in a square hole. The majority of our great men aptly illustrate the subject, and what "Nauticus" would call the rule is clearly the exception—the fact being that our most successful inventors have been "persons of an opposite calling." A man is brought up as a herb-seller who is a profound mathematician. A boy is sent to mind a booksellers' shop, who is destined to become a great chemist; a miner becomes an eminent engineer; a mathematical instrument maker becomes the greatest improver of the steam-engine; and even "Nauticus" has ventured into subjects that his father never dreamed of. I do hope, therefore, that I shall never see such a remark again in the MECHANICS' MAGAZINE, although every advertisement states the necessity for a certificate of "previous occupation in the same line," no one being deemed capable of sucking eggs without a certificate from his grandmother! I am, gentlemen, your obedient servant, T. MOY. 1 Clifford's Inn, Aug. 13, 1859.

"Another discovery which occupies the Emperor for the moment to the exclusion of all other discoveries of the same nature," says the Paris correspondent of the *Morning Star*, "is a new machine for the arming of ships of war, which is said to be the most terrible engine of destruction yet invented. This machine consists in a combination of a whole broadside, being constructed so as to be fired at once, and to be directed to any given point, so that no enemy's ship, however powerful, could resist the shock, which would sink a whole fleet if within range. The contrivance is said to be an improvement on the infernal machine of Fieschi, which you must remember was a radius of small guns. So that you see even treason has its uses, and if the Fieschi artillery be but charged with the Orsini shell, why then destruction of human life will be achieved upon the grandest scale! The machine, which as yet bears no name, is to be acted upon by electricity, as no gunner could withstand the recoil (?). As the reporter of the superb invention naively exclaims,' 'Here is an invention which will leave far behind it the famous Armstrong gun, just tested with so much success in England.'"

Mr. Ward's newly invented arrangement of flag-signals, submitted for the approval of the Lords of the Admiralty, was tested at Woolwich this week, on board the Commodore's flagship Fisgard. The following account of the invention was written by the *Times* correspondent: The flags are half-a-yard wide and three yards long, in pendant fashion, and, according to the code of instructions for corresponding from ship to ship at sea, the blue flag was run up to the maintop, as a preparatory pendant, announcing the desire to communicate, and is also hoisted between each word so as to devide them into sentences. The coloured flag appeared at the mizen and foretop masts, forming the message, which was clearly distinguished and understood at the given distance. In a dead calm, when the flags cannot float, a line is run across from the mainmast head to the mizen mast head, or from one yardarm to another, so that the flags may hang down and be visible, as in a breeze. Commodore the Hon. J. R. Drummond, for whose inspection the trials of the new flags and also the ocean marine telegraph, by the same inventor, have been performed at Woolwich, has ordered the construction of full sized instruments of the last-named invention, which will shortly be tested at Woolwich, preparatory to a trial at sea and on the coast.

It is stated that the design of the rifled cannon used by the French was offered to the British Government in 1855. A similar invention by Count Cavalli, of the Piedmontese service, was also offered to our Government, but his plans were referred backwards and forwards until they were lost sight of.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 2996, 7, 9.
BOILERS AND THEIR FURNACES, &c. *None.*
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2981, 2986, 2995, 3004, 6, 12, 20, 22, 36.
SHIPS AND BOATS, including their fittings, 2982, 23.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 2977, 2980, 3000, 16, 39.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 21.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2979, 2991, 10, 13, 25, 27, 29, 33, 37, 38, 40, 44, 46, 47, 49, 52, 53, 54, 59.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 19, 45.
LIGHTING, HEATING, AND VENTILATING, 2987, 5, 24, 35, 55.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2990, 2, 4, 43, 57.
METALS, including apparatus for their manufacture, 3001, 40.
CHEMISTRY AND PHOTOGRAPHY, 2983, 58.
ELECTRICAL APPARATUS, 2984, 2997, 31, 51, 56.
WARFARE, 2990.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 2978, 2985, 2988, 2989, 2992, 2993, 2994, 2995, 3000, 3002, 3003, 3005, 3006, 1, 3, 8, 11, 14, 15, 17, 18, 28, 30, 32, 34, 42, 48, 50.

2978. H. HUTCHINSON. "Improvements in the manufacture of india-rubber goods." Dated Dec. 29, 1858.

Here in coating sheets of cloth, leather, or other material with india-rubber, when such sheets are to be cut up into shaped pieces, the patentee only coats such sheets with india-rubber at certain places, in pieces of the size and form required, and this he does by passing the sheets of cloth, &c., together with a sheet of india-rubber prepared in the usual manner, between rollers, on one of which a raised pattern is fixed, and this raised pattern, by pressing the sheet of cloth, &c., and the india-rubber together, causes the india-rubber to combine with the sheet of cloth, &c., at the parts touched by the pattern, whilst at the parts which receive no pressure no adhesion is produced between the cloth and the india-rubber. *Patent completed.*

2979. S. MORAND. "Improvements in apparatus for stretching fabrics." Dated Dec. 29, 1858.

This consists in forming a series of blocks which are to move in suitable grooves, simply touching each other at their ends, without being linked or attached together, but in place of making the blocks with square or flat ends, so that when in a straight line the whole of the surfaces of the two ends of two neighbouring blocks shall be in contact, the inventor so forms the ends of each block that when a series of them are in a straight line the neighbouring ones shall only touch each other at a point. Each end of each block is made to incline from the centre outwards to the four angles, by which when a number are set in a straight line the neighbouring ones will admit of passing in curved and inclined lines. Each block is made with a groove through which pins pass to admit of the endless rows of blocks being moved by toothed or chain wheels. *Patent abandoned.*

2980. A. V. NEWTON. Improvements in machinery for reaping and mowing." (A communication.) Dated Dec. 29, 1858.

This consists, 1, in connecting the finger bar to the main frame by an intermediate frame, the said intermediate frame being hinged to the main frame (front and rear) in a line, or nearly so, with the crank-shaft. 2, in a peculiar mode of raising and lowering the main frame so as to adapt the machine to mowing and reaping. 3, in the mounting of the cutter-bar in rear of the front edge of, and over the finger bar, so as to allow the cutting edge of the cutters to cross the edge of the finger-bar, and clip the grass, &c., as near as possible to the finger-bar. 4, in a method of construction of the finger-bars and guard-fingers, and the manner of securing the guard-fingers to the finger-bar, and of operating the cutters therein. *Patent completed.*

2981. T. W. GOWING. "An improved roughing for the shoes of horses and other like animals." Dated Dec. 29, 1858.

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Here the roughing consists of nails formed with spikes or projecting surfaces, and with shoulders which bear upon the outside or bottom of the shoe itself. *Patent abandoned.*

2982. H. N. Maynard. "Improvements in anchors, and in the manufacture of anchors." Dated Dec. 30, 1858.

This consists in making anchors of plates, bars, angle, and other sections of iron, cut to the necessary shapes, and rivetted, bolted, or welded together so as to obtain greater facility in their manufacture, and the advantage of an increase of strength throughout, with the use of much less weight of metal. *Patent abandoned.*

2983. F. Puls. "The treatment of hydrocarbons." Dated Dec. 30, 1858.

The inventor oxidizes hydrocarbons by acids or otherwise, and uses them in this oxidized state, either alone or mixed with other fatty substances, for combining them with alkaline lies, which combinations he uses as a lubricating material. *Patent abandoned.*

2984. H. C. Vion. "A new mode of obtaining atmospheric electricity, and terrestrial electricity, and its industrial applications, and in apparatus for the same." Dated Dec. 30, 1858.

This consists in an electric pile formed by the earth and by the atmosphere. The earth is the negative pole. The atmosphere the positive pole. *Patent completed.*

2985. F. Johnson and J. H. G. Wells. "Improvements in constructing breakwaters, and other similar structures." Dated Dec 30, 1858.

This consists in presenting to the action of the waves a surface of timber or iron, or both combined, held in a grooved iron or wood framing fixed to piers constructed of iron or wood piles, with screw at foot of same, the piles beings firmly braced together, and on the piers of which a superstructure may be erected for use as a pier, &c. *Patent abandoned.*

2986. J. F. C. Heyne. "Improvements in railway chairs and rails, and in the mode of fixing the same." Dated Dec. 30, 1858.

This consists of shaping longitudinally the inner surface of the rails or metals so as to present a transverse curvilinear concavity to the back of the chair, which is also placed in similar manner for receiving the same, whilst the outer surface of the rail is provided with suitable key plates fitting closely within the ordinary channel or groove of the same, and the whole secured together through the medium of bolts and nuts, by which arrangement the rails or metals on being worn out and flattened at the upper face, or portion thereof, may be taken out and reversed with greater advantage than at present, a key-way and key being employed in connection with the seat of the chair for tightening the rail when required, together with a double surface chair and tightening bolts at the joints, or the junction of the rails. *Patent abandoned.*

2987. T. Bell. "Improvements in purifying gas." Dated Dec. 30, 1858.

The patentee employs the residuum from the working of Longmaid's process for the manufacture of sulphate of soda. *Patent completed.*

2988. R. A. Brooman. "Improvements in stopping or closing bottles, jars, and other like vessels." (A communication.) Dated Dec. 30, 1858.

On the neck of the bottle, &c., to be closed two screw threads are cast of a diminishing pitch from the mouth downwards. Two indentations are made in opposite sides in a capsule of metal, and are so formed as to screw into or under the screw threads in the bottle, &c., and retain the capsule in the bottle; by simply turning the capsule in the reverse direction it will be unscrewed and released. The top of the capsule on the inside is finished with a block of cork, caoutchouc, &c. The bottle, &c., may be hermetically closed by screwing the capsule tightly down on the neck thereof. Where the screw threads on the bottle, &c., are of glass, the inventor roughens their under surfaces to prevent the indentations on the capsules accidentally slipping up them. *Patent abandoned.*

2989. R. A. Brooman. "Improvements in washing and drying machinery and apparatuses." (A communication.) Dated Dec. 30, 1858.

According to one modification of this invention, of which there are several included in the specification, the machines are made of beaters, or beaters and rollers, as follows:—Several stampers are suspended from a cranked axis, which upon being rotated, causes the stampers alternately to rise and fall upon the articles to be washed, which are held in a trough with perforated sides and bottom, the bottom being under water contained in an outer trough. Under the bottom are springs which have a tendency to force up the inner trough, and greatly assist the washing operation. Inclined sides may be fitted to the outer trough on which the articles washed may be placed to drain, and they may be also passed between rollers to express the water after being removed from the trough. *Patent completed.*

2990. R. A. Brooman. "Improvements in revolving fire-arms." (A communication.) Dated December 30, 1858.

This consists in so forming and fitting the revolving breech-piece of revolving fire-arms that when they have to be charged it may be turned either downward, or to one side, or otherwise about a hinge or joint, either in conjunction with, or separate from, the barrel, and in fixing the said breech-piece in place after the chambers have been charged, by a rod passing through the breech-piece and engaging at the rear end in a female screw-thread, or other holding part, by a male screw thread, or a gaining or other projection. When a male screw-thread is used it is formed on a part of the circumference of the rod only, and makes about one-fourth a revolution. In order to withdraw the cartridges from the breech-chambers, the patentee sometimes makes use of a rod which is carried in the butt of the stock of the arm; or he employs a rod with a washer or ring at the extremity so arranged as to force all the cartridges out at once. *Patent completed.*

2991. R. A. Brooman. "Improvements in machines for embroidering." (A communication.) Dated Dec. 30, 1858.

According to this invention the festoon stitch is the result of two threads introduced into the fabric to be ornamented by one needle and one hook. The needle placed under the fabric is slightly bent back in order to allow the hook taking the thread from this needle to form a loop; the hook placed above the fabric directs the second thread in such manner as to form a knot above the fabric. Over the fabric is a small instrument called a pusher (*poussette*) intended to prepare the loop formed by the hook in order that the needle in again rising may not fail to seize the thread. Under the fabric is another instrument called a thread-grip (*serre-fil*) intended to tighten the knot formed above the fabric every time the hook recedes, and previous to the descent of the needle. *Patent completed.*

2992. R. A. Brooman. "Improvements in machinery for splitting or dividing hides, skins, leather, and other like materials." (A communication.) Dated December 30, 1858.

This consists 1, in the use of knives or cutters by preference serrated, and attached to a cutter-carrier the height of which is regulated by screws connected with its supports, and which receives a reciprocating motion from a main shaft by a connecting rod, or otherwise. 2, in the use of a roller for supporting the hides, skins, &c., as they are cut, which roller is incapable of ascending or descending motions, being supported in fixed bearings. 3, in the use of a moveable bar or presser-carrier for carrying a number of pressers which bear on the hides, skins, &c., as they are cut immediately in front of the knives, and which are kept down upon the hides, skins, &c., by springs. 4, in forming the said pressers each square or rectangular in section at their lower parts, and sinking these parts in a groove in the carrier to prevent their turning round, or otherwise moving improperly. 5, in giving motion to the cutter-carrier by a connecting rod or other appliance at the end of the said carrier, and not at or near the middle, to prevent trembling or unsteadiness of action. 6, in an arrangement of anti-frictional or other supports to enable the cutter-carrier to slide smoothly in its bearings. 7, in the use of a roller of less diameter at the middle than at the ends, for winding up the cut hides, skins, &c., and the method of driving this roller by means of worms and endless screws. 8, in a method of throwing the said roller in and out of gear by suitable levers, handles, &c. *Patent completed.*

2993. R. A. Brooman. "An improvement in pipes for smoking." (A communication.) Dated Dec. 30, 1858.

The object here is to prevent the essential oil of the tobacco and nicotine from being drawn into the mouth of the smoker. The invention consists in fitting a chamber between the bowl and the mouth-piece, and in placing tobacco, sponge, &c., therein to absorb the essential oil; also a piece of perforated plate, wire gauze, net, or other suitable fabric between the tobacco in the chamber and the mouth-piece. *Patent abandoned.*

2994. W. Burgess. "Improvements in apparatuses for converting reciprocating into rotary motion." (A communication.) Dated December 30, 1858.

This consists, 1, in the use of a sliding clamper block on a sliding rod in combination with an alternating clamping lever worked by a reciprocating rod, so that each alternation of the reciprocating rod the clampers of the clamping lever take hold of the opposite sides of an endless belt to continue its motion, and thus impart rotary motion to a shaft or shafts, over which the belt is passed. 2, in the addition to a treadle to drive the reciprocating rod of an elastic reacting spring to the underside of the foot rest of the treadle, so that when the toe of the foot rest is depressed, and in the giving back of the pressure of the foot the spring will cause the rest to follow the foot up. *Patent completed.*

2995. S. S. Batson. "Improvements in generating steam." Dated Dec. 30, 1858.

This consists in causing a supply of water to be forced by any suitable feed or force pump through a coiled pipe placed inside the body of the furnace fire and opening into the boiler. *Patent completed.*

2996. J. Knowelden and R. D. Edwards. "Improvements in hydraulic engines and apparatus connected therewith." Dated Dec. 30, 1858.

The patentee constructs the engine or apparatus with one or more cylinders with piston or ramrods, valves, &c., to be actuated by water pressure from the mains of the streets, or other sources; and when desidered they arrange with the apparatus an air chamber, for the purpose of arresting, checking, or softening by means of a volume of compressed air any violent action produced by the sudden stoppage of water, or by the weights to be stayed. The invention is applicable to various purposes. *Patent completed.*

2997. J. W. Duncan. "Improvements in or connected with appliances for transmitting or conducting signals or action by electricity or magnetism, and in the method of testing insulating materials, combinations, or structures, for conducting electricity, and in treating malconstructed or invalid electric telegraph cables, and in utilizing parts of certain cables, or the application otherwise of such structures, and in certain insulating compounds, and in the apparatus and machinery used in connection therewith." Dated Dec. 30, 1858.

The specification of this invention is so excessively elaborate that we cannot afford space for an intelligible abstract of it. *Patent completed.*

2998. J. H. Johnson. "Improvements in the permanent way of railways." (A communication.) Dated Dec. 31, 1858.

This consists in the use of fish-plates, or bars which hold the rails at their base, and by their lower rib or flange, in place of holding them on the sides of the web or narrow portion thereof. These fishes, which may be termed "under fishes," make use of the lower part of the rails for the purpose of consolidating their union, and are shaped to suit the various forms of rails to which they may be applied. There are modifications included. *Patent completed.*

2999. J. H. Johnson. "Improvements in the manufacture or production of boots and shoes, or other coverings for the feet, and in the machinery and apparatus employed in such manufacture." (A communication.) Dated Dec. 31, 1858.

This consists, 1, in an improved last or stand upon which the bottoms of boots or shoes are united to the uppers. 2, in countersinking the holes in which the fastenings are inserted for uniting the soles and heels to each other, and to the uppers or fronts 3, in a method of uniting the soles and heels to the other parts, and in a machine for that purpose. 4, in regulating the length of each fastening used in uniting the soles and heels with the uppers by a cam, on the surface of which the end of a lever rests, and which lever feeds the material into dies or shapers. *Patent completed.*

3000. H. Robin. "Improvements in reaping machines." Dated Dec. 31, 1858.

Here the cutting and gleaning machinery is supported by a framework, which allows the resisting and motive power to have direct play. It is fixed upon the axle-tree of the wheels, and fastened to the pole, which is lengthened behind, and the axis of which corresponds to the centre of the reaping machine. A horizontal cross-bar is fixed against the pole on each side to the collar of the horses. The varying height of the cross-bar allows a greater or lesser inclination of the framework, and consequently the wheat, hay, or grain may be reaped at any given altitude. *Patent completed.*

3001. M. D. Wyatt. "Improvements in tiles and tessarae and other wall coverings, and in the means of securing the same to walls and buildings." Dated Dec. 31, 1858.

The patentee makes the tile with a projecting piece of a dovetail form at the upper part, which piece may project about 3½ or 4 inches, or a little more than the height of the thickest course of ordinary brickwork. Thus, at whatever part of the wall the tile may be applied, the dovetail piece will cross a course of the mortar. Between the bricks a nail is driven into the mortar on each side of the dovetail, and the tile is thus secured. The next tile is made to lap over and hide the dovetail, which is set back in a different plane

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from the face of the tile. There are modifications included. *Patent completed.*

3002. T. Z. L. MAUREL. "An apparatus protracting indefinitely the working of any mechanism set in motion by springs, more generally applicable to clock-making." Dated Dec. 31, 1858.

The inventor proposes to furnish any mechanism motived by springs—a clock, for instance—with a series of small barrels of equal size, turning in the ordinary manner, independent of their axes, and communicating with each other by wheels of equal diameter. Each of these barrels has a spring attached by one extremity to the drum or cylinder of its barrel, and by the other to its spindle, the position of each spring being regulated by the number of barrels employed. The shaft of the first of these barrels carries at one extremity a handle by which it is turned, and at the other a paul and pinion to prevent its return; the shaft of the last barrel carries a wheel, by which it is connected by the ordinary clockwork. Supposing twelve barrels to be used, by turning the handle on the shaft of barrel No. 1, he successively winds up the springs of each barrel up to No. 12 (he usually places two barrels upon each shaft, excepting the first and last, which carry but one), the shaft of which carries the wheel, gearing on to the ordinary clockwork. The clock being set in motion, it follows that as the spring No. 12 goes down, it is every moment rewound up by spring No. 11, and so throughout the series, until all the springs run down together. *Patent abandoned.*

3003. J. LEES and W. HEAP. "Improvements in machinery for punching square holes in the ends of rollers and other articles." Dated Dec. 31, 1858.

This consists in so constructing machinery for punching square holes in the ends of rollers and other articles, that each article is presented in succession to a series of punches fitted in a circular bush, to which an up and down or to and fro motion is given. *Patent completed.*

3004. J. H. SIEVERS. "Apparatus for tightening and releasing the belly-bands of riding saddles." (A communication.) Dated Dec. 31, 1858.

The object here is to enable the rider while on horseback to tighten the belly-bands should it be required, and to facilitate the putting on and taking off of saddles. The apparatus is contained in a flat box of metal fixed to the right-hand side of the saddle. *Patent abandoned.*

3005. F. W. A. CASPER and G. H. SCHMAHL. "Using spart or Spanish broom in manufacturing seats of all descriptions." Dated Dec. 31, 1858.

This consists in using spart, a kind of tender shrub growing in some mountainous parts of Spain, for manufacturing seats of all descriptions, but especially those for the use of kiosques, bowers, green arbours, &c. *Patent completed.*

3006. L. A. NORMANDY. "A new system of shaft tugs." (A communication.) Dated Dec. 31, 1858.

This is essentially composed of metal supports, coated or not with paint, &c. These supports are attached by buckles or otherwise to the harness. *Patent completed.*

3007. J. H. JOHNSON. "Improvements in the manufacture or production and casting of steel, and in the apparatus employed therein." (A communication.) Dated Dec. 31, 1858.

This relates to certain processes for manufacturing and melting steel, whereby cast steel may be obtained in sufficient abundance for casting articles of extreme size, such as ordnance or large bells, &c. By this invention, also, the use of the ordinary melting pots is dispensed with." *Patent completed.*

1. J. T. PITMAN. "An improved mode of making and fitting bungs to casks and other vessels." (A communication.) Dated Jan. 1, 1859.

This consists in forming a screw on the bung or stopple, and a corresponding one at the hole in the stave of the barrel or cask by burning. The invention is not fully described apart from the drawings. *Patent completed.*

2. H. C. TRAPHAGEN. "Improvements in skirts for ladies." Dated Jan. 1, 1859.

This consists in attaching to the body of a skirt a series of light air-tight tubes, to be inflated with air. *Patent abandoned.*

3. A. ANDERSON. "An improvement in governors for machinery. Dated Jan. 1, 1859.

This invention is an application of the sensitiveness of the well-known instrument called the gyrascope to the regulation of the speed of machinery. *Patent abandoned.*

4. B. J. GOSTEAV. "An improved gridiron, which may form a complete cooking apparatus." Dated Jan. 1, 1859.

This consists in a cooking apparatus in which the fuel is placed upon a shelf formed of wire gauze, the meat, &c., to be cooked being placed immediately underneath. *Patent completed.*

5. J. E. DROUOT. "Improvements in bakers' ovens." Dated Jan. 1, 1859.

This consists in a mode of constructing bakers' ovens so that the patentee can bake, and produce at the same time the steam necessary for working a motive power. *Patent completed.*

6. W. FOOTMAN. "Improvements in brakes for retarding and stopping railway trains, carriages, and other vehicles." Dated Jan. 1, 1859.

Here a solid or tubular shaft is placed in bearings beneath the carriage. On this longitudinal shaft is formed or fixed a short endless worm or screw gearing with a toothed wheel fixed on a transverse or brake shaft, and near each end or in the middle of this brake shaft are formed two cranks or excentrics, to which the rods of the brake blocks are attached. When the longitudinal shaft is made to revolve, its endless screw turns the toothed wheel fixed on the brake shaft, and causes the cranks or excentrics to act and give a thrust to each of the rods to which the brake blocks are attached, so as to press the blocks against the peripheries of the wheels of the carriages to which the brakes are applied. There are modifications included. *Patent abandoned.*

7. J. OLIVER. "Improvements in lubricators for steam engine cylinders." Dated Jan. 1, 1859.

Here the oil, &c., is placed in a vessel which communicates with the interior of the steam engine cylinder by a neck or pipe, and is covered by a screw cap. In this neck or pipe is a small chamber containing a valve which rests upon a seat at the bottom of the chamber. The upper surface of this valve is also faced; or two valves are connected together, and the upper face or valve shuts against an inverted seat in the top of the chamber. Thus the valve is closed against the lower seat when down, and against the upper seat when up. The valve may be guided by a triangular stem or otherwise. *Patent completed.*

8. J. WALKLAND. "An apparatus for lighting cigars and tobacco." Dated Jan. 1, 1859.

This relates to a portable metallic box or case adapted for the use of smokers; it is formed with indentations for the reception of any desired number of small wafers of suitable material, steeped in a solution of nitre, or other salt that will render them combustible without causing them to be explosive or susceptable of bursting into flame. In the centre of each wafer is a hole bushed with a detonating compound, and in the centre of the receiver or indentation in the case is a corresponding hole, and through these holes a small rod or needle is drawn to produce ignition by friction. *Patent abandoned.*

9. J. GARFORTH. "Certain improvements in steam engines." Dated Jan. 1, 1859.

This relates to reducing the area or steam surface, of the cylinder and piston so as to enable the inventor to employ high pressure steam in the cylinders (as it comes from the boiler or nearly so) during the entire length of the stroke (if required). The invention consists in the use of two cylinders, one arranged within the other, the inner cylinder being supplied with steam at a low pressure, and the space between the cylinders being supplied with high or low pressure steam, the piston of the outer cylinder being annular in form, and having two piston-rods which are connected by a crosshead to the rod of the centre piston. *Patent abandoned.*

10. H. ASHWORTH. "Certain improvements in power looms for weaving." Dated Jan. 1, 1859.

This consists in providing a roll of flannel, &c., within the picker so that the motion of the picker along the wire or guide shall effect the lubrication, by carrying with it the flannel roll which is to contain the oil of lubrication, and which may be supplied thereto through a hole in the top of the picker. *Patent abandoned.*

11. R. SMITH. "Improvements in casting, appliable to printing surfaces, and for other purposes." Dated Jan. 1, 1859.

This relates, to arrangements applicable in casting various articles, and designed in part to facilitate the withdrawal of the casting from the mould, and in part to facilitate the removal of superfluous metal. The details of the invention may be variously modified. *Patent abandoned.*

12. P. E. GUERINOT. "Improvements in the application of an apparatus to railway locomotives, waggons, and carriages, for the purpose of lessening the effect of concussion in the event of collision." Dated Jan. 1, 1859.

This relates to a previous patent, and the chief feature in the invention is the use of pointed steel rods and corresponding lead blocks, the steel rods being forced into the lead blocks in the event of collision. *Patent completed.*

13. W. ECCLES. "Improving the machinery or apparatus for regulating the tension of the twist threads or warp whilst it is weaving in power looms into cloth." Dated Jan. 1, 1859.

This relates, 1, to certain improvements in the "back beater," otherwise "back rest;" and, 2, to the weight levers or apparatus, which, acting on the ropes at the back of the loom, keep the yarn in a state of tension. *Patent completed.*

14. M. WIGZELL. "An improved form of nail or driving article." Dated Jan. 1, 1859.

The forms of nails described are wholly or partly twisted or spiral, and are such that nails made as described offer a greater resistance to drawing than the ordinary nails or other driving articles, as they cannot when driven be withdrawn by a direct strain, without tearing away the wood into which they are driven. *Patent completed.*

15. A. PRINCE. "Improvements in the construction of cylindrical presses." (A communication.) Dated Jan. 1, 1859.

This consists of certain mechanical arrangements whereby a continuous pressure is obtained, and is particularly adapted to the extraction of juice from fruit or plants, oils, and other liquid matters. *Patent abandoned.*

16. W. A. VON KANIG. "Improvements in machinery or apparatus for digging and cultivating land." Dated Jan. 1, 1859.

This relates to arrangements whereby mechanical diggers or workers are contrived for digging up, working, and cultivating land under various circumstances, under the operative power of steam, or other available mover. *Patent completed.*

17. J. HARRIS. "Improvements in apparatuses for regulating the pressure and flow of steam, water, and other fluids." Dated Jan. 1, 1859.

This relates principally to apparatuses for reducing high pressure fluids to any given pressure below that in the boiler, water main, gas main, or any other main, or for allowing steam or other fluid when it has attained a given pressure to escape either into a second receiver, or into the open air through a safety valve or danger signal or otherwise. The various features comprised in this invention we shall probably describe in a future number. *Patent completed.*

18. J. WOOD. "Improvements in cutting and finishing corks, and in machinery used for such purposes." (A communication.) Dated Jan. 1, 1859.

This consists in the use of an adjustable table, over which a series of spindles, furnished at their lower ends with sharp-pointed cutters, are so mounted as to be capable of rising and falling at regular intervals by means of cams, and at each descent each of the spindles cuts a cork from the block of cork wood placed beneath them. These spindles are driven by bands from a drum. There are various other details, but the invention is not fully described apart from the drawings. *Patent completed.*

19. G. SKINNER AND J. WHALLEY. "Improvements in the manufacture of ornamental and other tiles and other similar articles." Dated Jan. 1, 1859.

The patentees use the materials in a semi-fluid state, and employ a metal case in two parts, the sides of which are lined with filtering material, and when used are firmly bolted together so as to constitute a species of filter. This instrument they call a power loom, and in it tiles, &c., are formed and decorated at the same time. *Patent completed.*

20. J. BROWN, jun. "Improvements in buffers, draw springs, and bearing springs." Dated Jan. 1, 1859.

This consists in constructing railway buffers, draw springs, or bearing springs each with two or more spiral springs, supported and kept in their proper positions by tubes connected together by telescopic joints, each spring having a separate set of tubes. *Patent abandoned.*

21. G. T. BOUSFIELD. "Improvements in machinery for forming dough into cakes or bread crackers." (A communication.) Dated Jan. 1, 1859.

This invention is not described apart from the drawings. *Patent completed.*

22. A. L. LEVEQUE. "An improved apparatus for subduing or stopping runaway or restive horses." Dated Jan. 1, 1859.

This consists in providing the headstall or other parts of horses' bridles with an apparatus to be actuated by the driver or horseman, and by means of which suitable parts of the horses' sight may be covered for inducing the horse to put his head in the required position for the due acting of the bit. *Patent completed.*

23. J. B. MORGAN. "Improvements in propelling navigable vessels." Dated Jan. 1, 1859.

This consists of a submerged vertical flat blade or vane, of a square form, mounted vertically between the two outer ends of two horizontal arms so that it is at liberty to turn freely on its axis from about 45 to 80°. The arms have a horizontal semi-circular

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motion communicated to them through a vertical driving shaft to which one or both of the arms are stalked. The motive power is applied to the vertical driving shaft by a rack and pinion, crank, &c. The propelling blade is placed in an opening in the dead wood of the run of the vessel, or in a frame work placed beyond the stern, or projecting forward from the bow, or placed below the keel. *Patent completed.*

24. J. LUIS. "New economical candles." (A communication.) Dated Jan. 3, 1859.

These candles are of two sets, one having two plaited wicks lasting from 5 to 6¼ hours, and giving a light equal to two and one third candles; the other has but a single plaited wick not occupying the centre of the grease. *Patent completed.*

25. R. TEMPEST and J. TOMLINSON. "Improvements in certain machines for preparing cotton and other fibrous materials." Dated Jan. 3, 1859.

Here the catch lever to which the spout or trumpet mouth is fixed is jointed between its fulcrum and the calender rollers, so that when the sliver breaks the lever with the spout or trumpet mouth can easily be raised to facilitate the removal of the knot or other impurity which caused the sliver to break. There is also an opening spout, instead of a circular trumpet mouth to guide the sliver to the calender rollers. *Patent completed.*

26. M. A. F. MENNONS. "Certain improvements in steam generators." (A communication) Dated Jan. 3, 1859.

This consists in the addition to boilers and other steam recipients of an auxiliary feeding apparatus for the introduction of cleansing or protecting solutions, and in the arrangement for effecting this introduction during the work of the boiler by the pressure of the steam evolved. *Patent completed.*

27. C. B. BLYTH. "Improvements in machinery for preparing and treating jute, hemp, flax, and other fibrous materials." Dated January 3, 1859.

This relates to machinery employed in the operation of "softening." It consists in arranging machinery with three or more rows of rollers, which the patentee mounts within the same machine framing, and drives by bevil gearing. He feeds the material between two rows of rollers—say the bottom and middle set of rollers, when three rollers or sets of rollers are used—and returns it back again between the middle and top row or set of rollers, by a return feeder, which carries the material from between the first set or rows up to or between the next set or rows of rollers in the series composing the machine, when it is again subjected to a continuation of the treatment it received in its progress through the first set of rollers. *Patent completed.*

28. E. BALCHIN. "An improved construction of projectile, applicable to the whale fishery." Dated Jan. 3, 1859.

The patentee proposes to employ, in conjunction with the ordinary harpoon, a hollow lance or pointed shell, which is to contain a charge of powder, and may be fired into the whale with the view of striking some vital part while, or just before, the harpoon to which a line is attached is discharged as heretofore to secure the fish. *Patent completed.*

29. W. and T. RENTON and W. BINNS. "Improvements in raising the nap or pile of textile fabrics." Dated Jan. 3, 1859.

Here two raising cylinders are used and two beds. The fabric is kept distended, and is moved slowly over a bed in the shape of a trough, the fabric when being raised resting on the two sides of the trough, whilst the part of the fabric which is across the trough is allowed to assume a curved form, corresponding with the curvature of the raising cylinder, or the trough is filled with elastic material so as to present an elastic bed for the fabric. The first raising cylinder is wound round with fillet cards in a direction from the centre or middle outwards towards each end of the cylinder, so that in its revolution this cylinder will raise the nap on the fabric in a direction from the middle outwards towards the two selvages. The second raising cylinder sets the nap in the usual manner. *Patent completed.*

30. J. and T. FURNIVAL, J. DERBYSHIRE, and F. J. EMERY. "Improvements in apparatus for supporting articles of china and earthenware in kilns and ovens." Dated Jan. 3, 1859.

This invention is not described apart from the drawings. *Patent completed.*

31. L. J. HIGHAM. "Improved means for obtaining submarine electrical conduction." Dated Jan. 4, 1859.

Here a jointed case is employed for protecting the insulated wire. *Patent abandoned.*

32. J. BUCHANAN. "Improvements in oil cans, or lubricating apparatus." Dated Jan. 4, 1859.

This oil can is intended to be used in lubricating the working parts of machinery. The oil reservoir is in the form of a long narrow cone of tinned plate, the dropping discharge aperture being on the extreme end of the cone point. The base consists of a dished disc of tinned plate. This disc is concave externally, and through its centre there is entered a short and narrow slightly conical tube, open at both ends. This tube is soldered into the base disc, and when the can is upright it stands up to a little above the height at which it is intended that the oil should stand in the reservoir when newly supplied. The result of this arrangement is obvious. *Patent abandoned.*

33. J. B. JOYCE. "Improvement in means, machinery, or apparatus applicable to wool combing." Dated Jan. 4, 1859.

This relates to apparatus for drawing the wool from the combs of that class of combing machines wherein portable combs are used, and consists in so constructing and arranging machinery as to be self-acting for receiving the combs when taken from the combing machine, transferring them to the drawing-off rollers and noil strippers, and delivering them in a proper position for being replaced on the combing machine. *Patent completed.*

34. W. HOOD. "Improvements in racks and water cisterns for stables." Dated Jan. 4, 1859.

This invention was described and illustrated at page 76, No. 5 of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

35. A. BEDBOROUGH. "An improved chimney cowl and ventilator." Dated Jan. 4, 1859.

This consists of an inner tube or conical-shaped flue, surrounded by an outer case, in the sides of which are transverse openings, with deflecting plates to give an upward direction to the air entering through them; about two to four inches more or less from the top of the central tube there is a stop plate which entirely covers all direct access to the tube from the top of the cowl. The smoke is carried off through apertures made and fitted in the form of an ornamented top which communicates with spaces outside of the covering plate before alluded to. Water is carried off from the covering plate through side apertures, and through tubes which direct the water through the transverse openings in the case outside of the inner tube and tend to keep them clean. *Patent completed.*

36. E. de FOREST. "An improvement in the manufacture of springs for carriages and other uses." (A communication.) Dated Jan. 4, 1859.

Here the vulcanized india-rubber, &c., is interposed between the weight to be supported and sustaining levers; or between the bearing surfaces and the sustaining levers. *Patent completed.*

37. F. CLARK. "Improvements in connecting knobs and handles to the spindles of locks and latches, and other articles of a like nature." Dated Jan. 5, 1859.

This invention is not described apart from the drawings. *Patent completed.*

38. W. DRAPER. "Improvements in machinery for printing on paper and other fabrics." Dated Jan. 5, 1859.

This consists in combining together two apparatuses, similar to those ordinarily used, so that two lengths of paper, &c., may be printed at the same time. It also consists in apparatus for moving the paper, &c., forward after each impression; also, in a method of applying the colour to colouring rollers. *Patent completed.*

39. J. HOWARD. "An improved construction of lever-neck plough." Dated Jan. 5, 1859.

This relates to ploughs which have a cast iron frame, and an adjustable lever for carrying the ploughshare, the chief object being to strengthen the socket end of the plough frame, and at the same time protect the lever neck from wear by keeping it from contact with the ground. It relates particularly to the plough patented July 3, 1853. The patentee now proposes to cast on the forward end of the plough-frame a socket, which is closed on all sides, but open at the ends to allow of the lever neck being passed through it. *Patent completed.*

40 R. RUMNEY and W. S. MACDONALD. "Improvements in printing and dyeing woven fabrics and yarns or threads." Dated Jan. 5, 1859.

This relates particularly to dyeing and printing fabrics and yarns or threads with colour derived from uric acid—murexide, for instance—and to combinations of other colouring matters therewith. *Patent completed.*

41. A. V. NEWTON. "An improvement in the process of, and improved apparatus for separating metals from their ores." (A communication.) Dated Jan. 5, 1859.

This relates to apparatus for effecting the intimate combination of gold or silver with mercury for separating the precious metals from the ground or pulverized ores of those metals. The apparatus (which is erected in a closed apartment heated by steam) consists of a main shaft turning in bearings and carrying a series of chambers for receiving the ore. These chambers are arranged radially around the same hub or boss. Into these chambers the ore is placed, and and mercury added thereto. Rotary motion is given to the apparatus, and an artificial heat kept up. There are other features included in the invention. *Patent abandoned.*

42. W. CORFIELD, jun. "Improvements in chains for coupling, cranes, cables, mining purposes, hoisting, and all other purposes where chains are used." Dated Jan. 5, 1859.

Instead of making chains of single links, it is here proposed to form them of double links, one set being a little longer than the other, so that when any strain is applied the short links only receive it; but should any of the short links break or snap, the longer links then take the strain. *Patent completed.*

43. J. KIRKMAN and I. GRUNDY. "Improvements in certain kinds of bed covers or counterpanes, and other textile fabrics of similar character, and in the mode or method of weaving the same." Dated Jan 6, 1859.

This applies to fabrics known as Bolton or Marseilles quilts, or others of like texture. So far as relates to the fabric or tissue produced, it consists in the combination of a new and peculiar kind of ground with a damask or calico figure. This ground is produced by the intertexture of the binding weft with both parts of the warp. The figure combined with the ground is produced by a double pick of weft thrown in for each card. There are various other features included. *Patent abandoned.*

44. G. BURY. "Improvements in part or parts of apparatus commonly used and applied for effecting the pick in power looms for weaving." Dated Jan. 6, 1859.

This relates to looms in which the picker is ordinarily connected to the picking stick by a cord or leather strap, and they consist in the substitution for the strap of a flexible metallic connection such as an iron chain; and also in the application of a metal ferrule encircling the end of the picking stick. *Patent abandoned.*

45. H. G. COOMBS. "An improved method of constructing railings, bars, gates, gratings, columns, and all other builders' work of a like nature or description." Dated Jan. 6, 1859.

This consists in the application of wrought or other iron or metal tubes, together with iron or other metal fittings, ornaments, or fixings to the same in the shape of caps, bases, crossrails, or otherwise, to be fixed thereto by screws, pins, or rivets, or by heat as required. *Patent abandoned.*

46. E. T. HUGHES. "Improvements in machinery or apparatus for preparing cotton and other fibrous materials to be spun. (A communication) Dated Jan. 6, 1859.

This relates to carding engines, and consists in arranging an additional cylinder to the ordinary carding engine which receives the material to be carded from the feeding rollers, and passes it either direct to the ordinary large cylinder, or through the medium of a breaker. *Patent abandoned.*

47. W. and T. RENTON, and W. BINNS. "Improvements in finishing woollen and other fabrics." Dated Jan. 6, 1859.

This consists in subjecting woollen fabrics, &c., to hydraulic pressure. *Patent completed.*

48. J. ASPINALL. "Improvements in machines for the manufacture of bolts, rivets, and spikes. Dated Jan. 6, 1859.

The patentee claims, 1, the use and adaptation of the direct action of steam or of a hydraulic ram to the forming of bolts, rivets, or spikes, by a blow or succession of blows. 2, the construction of punch boxes and dies, both as described with reference to the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 23, 1859.

1507. M. A. F. Mennons. Improvements in machinery for the manufacture of bolts and rivets. A communication.

Dated July 16, 1859.

1682. J. Bernard. Certain improvements in the manufacture of boots and shoes, and in the machinery and apparatus to be employed therein.

1686. O'D. Grimshaw. Improvements in safety letter boxes or bags.

Dated July 20, 1859.

1706. W. J. and D. Gradwell. Certain improvements in bearings or journals employed in machinery, which improvements are also applicable to the bearings of railway and other wheels and axles.

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Dated July 21, 1859.

1714. C. and J. B. Tapp. Improvements applicable to steam boilers and furnaces for consuming smoke and economizing fuel in the generation of steam, and in the apparatus connected therewith.

Dated July 26, 1859.

1734. W. H. Buckland. An improved preparation of peat.

1736. P. D. Mickles. An improved spring for railroad and other carriages, and for other uses and applications where springs are required. A communication.

1737. J. Hinks and G. Wells. An improvement in, or a substitute for, the hook of the ordinary hook and eye dress fastening.

1738. J. Gillott and J. Morrison. New or improved machinery for the manufacture of the handles of penholders, which machinery or a part or parts thereof, may also be employed for manufacturing other cylindrical articles.

Dated July 27, 1859.

1740. M. A. F. Mennons. An improved comb-cleaner. A communication.

1742. J. Davies. A new or improved self-adjusting ventilating apparatus.

1744. J. Scoffern. Improvements in waterproofing, cementing, and stiffening fabrics and fibrous materials, and also in dyeing fabrics and fibrous materials.

Dated July 28, 1859.

1746. W. Hudson and C. Catlow. Certain improvements in looms for weaving.

1747. E. Hunt and H. D. Pochin. Improved resin and resinous substances.

1748. A. Sidebottom. Improvements in the mode or process of separating animal fibre from mixed fabrics of animal fibre and cotton or other vegetable fibre.

1749. C. W. Smith. Improvements in electric telegraphs, and in apparatus connected therewith.

1750. W. Kent. A self-acting fan.

1751. J. W. D. Brown. Improvements in signal and lighthouse lamps and lanterns.

1753. W. E. Newton. Improvements in grinding mills. A communication.

1754. W. Clark. Improved apparatus for turning over music leaves or sheets. A communication.

1755. J. Jackson. Improvement in metal pens.

1756. P. Robertson. Improvements in the manufacture of beer, ale, porter, and spirits.

Dated July 29, 1859.

1757. T. Culpin. Improvements in water-closets, water-cisterns, urinals, baths, lavatories, and other sanitary apparatus, and in the mode of supplying water thereto.

1758. I. M. Lindley. Improvements in cop-tubes.

1759. J. Wright. An improved method of raising or drawing up the skirts of gowns or dresses. A communication.

1761. P. A. Victte. Improvements in engraving on metal or on other substances decomposable by acids or corrosive salts.

1762. J. Chandler. Improvements in apparatuses for indicating the water level in boilers and other vessels, parts of which are also applicable for inspecting the interior thereof.

1763. T. J. Terrell. An improvement in ships' riding bits, and "timber heads."

1764. A. V. Newton. Certain improvements in that class of fire-arms known as revolvers, and in bullets for the same. A communication.

Dated July 30, 1859.

1765. J. Wood. An improved truss for hernia.

1767. G. Gurney. Improvements in electric telegraphic conductors.

1769. T. Firth. An improved breech-loading cannon.

1771. A. B. Wilson. Improvements in the manufacture of hats.

1773. P. M. Parsons. Improvements in switches and crossings of railways.

Dated Aug. 1, 1859.

1775. J. Molladay. An improved form or construction of hat, cap, or covering for the head.

1777. T. G. Messenger. Improvements in the construction of buildings or erections to be used for horticultural or other purposes.

1779. J. Rowland. An improved apparatus for mashing and mixing.

1781. W. E. Newton. An improvement applicable to salinometer cases for steam boilers. A communication.

Dated Aug. 2, 1859.

1783. J. C. Ashwell. Improvements in wheels for railway and other carriages.

1785. H. Olorenshaw. An improvement in neck-ties.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

1849. G. T. Bousfield. A new and useful method of manufacturing the vulcanized compounds of vulcanizable gums. A communication. Dated Aug. 9, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Aug.* 16, 1859.)

822. Y. M. Thomas. Propeller.
832. M. Coupland. Furnaces.
850. E. Fairburn. Carding wool.
852. F. C. Bakewell. Fire-places. A communication.
853. G. F. Chantrell and E. Dutch. Water-closets.
855. J. Hetherington, T. Webb, and J. Craig. Spinning and doubling.
856. T. Scott. Fibrous materials.
864. J. Scoffern. Lubricating projectiles.
865. D. Moseley. Carding cotton.
880. N. A. Grumel. Dyeing cotton, &c.
888. T. Barnett, H. T. Sourbuts, and W. Loynd. Steam-engines.
891. J. H. Johnson. Cyanide of potassium. A communication.
895. W. E. Newton. Steam-engines and boilers. A communication.
923. R. Emery. Carriages.
924. W. A. Martin and J. Purdie. Fire-bars.
928. W. Craft and T. Wilson. Pinafores.
938. J. Beattie. Preventing carriages running off the rails.
945. S. Barnwell and A. Rollason. Umbrellas, &c.
948. G. Abeillou. Arching plane.
957. W. E. Newton. Alumina. A communication.
960. H. Harrison. Looms.
985. P. and J. Reynolds. Hackling flax, &c.
991. A. V. Newton. Seamless bags. A communication.
1043. R. Main. Wheels.
1051. J. H. Johnson. Polishing knives. A communication.
1087. W. Clark. Supplying air to diving bells. A communication.
1091. J. Souquiére. Distilling coal.
1109. W. Sellers. Screw bolts and nuts.
1204. W. S. Thomson. Skirts. Partly a communication.
1412. W. Sellers. Ovens.
1560. J. Lawson and S. Cotton. Roving, twisting, and spinning.
1580. T. J. Hart. Fire-arms.
1595. C. Barlow. Capstans. A communication.
1626. E. Livermore. Fluids for burning. A communication.
1658. A. Cooper. Grips of swords.
1681. J. Bernard. Pumps.
1682. J. Bernard. Boots and shoes.
1691. J. Bernard. Boots and shoes.
1720. S. A. Bell and J. Black. Fusee.
1759. J. Wright. Raising skirts. A communication.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 12, 1859.

408. J. Parkinson.
410. C. Sanders.
414. R. Clegg, F. Angerstein, and J. W. Page.
420. W. Raymond.
421. J. Paterson.
423. G. Bedson.
426. S. Bailey.
428. C. E. Wright.
446. T. Cattell.
447. F. W. Emerson.
448. C. Fay.
461. W. Clay.
462. W. Basford.
464. C. F. Vasserot.
467. F. P. J. Van den Ouwelant.
469. O. Blake.
471. T. Wilson.
475. R. Jobson.
477. R. W. Johnson and W. Stableford.
490. S. Ridge.
507. E. Price and E. Hawkins.
514. R. and T. Fielden.
520. J. Lee.
528. G. Horner.
539. H. Moule.
547. P. Currie.
557. J. H. Johnson.
584. W. P. Savage.
585. F. Verdeil and E. Michel.
604. C. Mills.
665. J. Michel-Denys.
704. W. & S. Pickstone.
739. J. Evans
768. M. A. Muir and J. McIlwham.
811. W. E. Newton.
867. R. Postlethwaite.
896. H. F. Gardner.
908. W. H. Barlow.
1033. T. A. Weston.
1098. J. Childs.
1124. J. Scholfield and W. Cudworth.
1194. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin.
1249. G. R. Sampson.
1258. T. S. Cressey.
1265. J. H. Mason and G. L. Baxter.
1272. N. S. Dodge.
1274. N. S. Dodge.
1286. M. A. F. Mennons.
1299. J. Reynolds.
1302. J. Young.
1375. E. Gill.
1400. A. V. Newton.
1415. J. James.
1448. C. Wilkinson.
1453. E. A. Cutler.

Sealed August 16, 1859.

474. P. Spence.
478. J. Schloss.
485. E. Lund.
486. R. A. Brooman.
488. W. Gossage.
491. W. Ashton.
493. U. Scott.
495. S. R. Samuels.
498. H. B. Barlow.
503. J. Crosland.
504. A. Lançon, jun.
575. J. Cowban and E. Andrews.
586. G. Leach.
598. J. P. Clarke.
643. T. Lightfoot.
655. J. Dixon and R. Clayton.
770. B. & C. L. Smith.
1189. D. Foxwell.
1275. A. V. Newton.
1392. R. R. Fairgrieve and S. Bathgate.
1394. J. and W. Henderson, T. Bagley, and S. Holdsworth.
1428. A. V. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1881. A. L. Reid.
1899. E. Hallen and W. H. Kingston.
1909. A. Priest and W. Woolnough.
1917. J. W. D. and G. G. Brown.
1952. J. Crossley and J. Bolton.
1988. E. A. Cowper.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Aug. 13, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
32	0 3	40	0 3	50	0 10	58	0 3	66	0 3	74	0 5
33	0 10	42	0 3	51	0 4	59	0 10	67	0 3	75	0 10
34	0 5	43	0 3	52	0 7	60	0 6	68	0 8	76	0 3
35	0 5	44	0 3	53	0 3	61	0 3	69	0 6	77	0 10
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38	1 4	48	1 1	56	0 3	64	0 3	72	0 6	139	0 6
39	0 6	49	0 3	57	0 3	65	0 3	73	0 8	207	0 8

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, 19th August, 1859.

	£ s. d.	£ s. d.	Pm. p. ct
IRON, Rails in Wales and N. of England ..... pr. ton	6 0 0 to		nett
Welsh Bars, in Wales .. „	5 15 0 „	6 5 0	"
Staf. Bars at the Works „	7 0 0 „	7 10 0	2½
„ Hoops ..... „	8 0 0 „	8 10 0	"
„ Sheets, Singles .. „	8 10 0 „	9 0 0	"
„ Nail Rods ..... „	7 0 0 „	7 10 0	"
„ Boiler Plates .... „	8 10 0 „	9 0 0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow..... „	2 12 6 „	2 12 9	nett
Do. No. 1, Good Brands „	2 13 3 „	2 15 0	"
Scotch Bars ..... „	7 0 0 „	7 15 0	5
Swedish Bars, in London „	13 10 0 „	15 0 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 12		5
Tough Cake and Tile „ ton	107 10 0		"
Best Selected..... „	110 10 0		"
Australian ..... „	110 10 0 „	111 0 0	"
South American .... „			"
Yellow Metal Sheathing..... per lb.	0 0 10		"
STEEL, Swedish Keg ..... pr. ton	18 15 0 „	19 0 0	2½
„ Faggot ..... „	20 15 0 „	21 0 0	"
TIN, English, Block ..... pr. cwt.	6 18 0		3½
„ Bar..... „	6 19 0		nett
Foreign, Banca ..... „	7 5 0		"
„ Straits..... „	7 0 0		"
TINPLATES, Charcoal, I.C. ..pr. box	1 13 0 „	1 14 0	5
„ Coke, I.C. ..... „	1 7 0 „	1 8 0	"
LEAD, Pig, English ..... pr. ton	22 15 0 „	23 5 0	2½
„ Spanish ..... „	22 0 0 „	22 10 0	"
„ Sheet ..... „	23 15 0 „	24 0 0	"
SPELTER, on the spot ..... pr. ton	21 0 0	21 5 0	net
for arrival..... „			"
ZINC, English, Sheet ..... „			1½
QUICKSILVER ..... per btl.	7 0 0		1½

LAWRIE AND HAGGER, Metal Brokers.
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, AUGUST 26, 1859.

BOAT-LOWERING APPARATUS.

Men and women are not very costly creatures. In this country, at any rate, the propagation of the species proceeds with (to say the least) all due rapidity. Our young people become men and women very early—considering the latitude of the land in which we live—and but few of them are men and women long before they become fathers and mothers. Hence we thrive so in the matter of population that we might well be pardoned for holding human life cheap among us. It cannot be of great consequence to us that a sailor more or less drops into the sea, and is left there. Nay, we may very well be supposed to spare a boat's crew, or even a ship's company, occasionally without much inconvenience. Even a few passenger ships might disappear annually without placing us in any kind of peril or extremity. With several millions of men and women encompassing us here in London alone, we can afford to lose an Avenger, a Birkenhead, an Amazon, an Arctic, occasionally. Had the Eastern Monarch gone down in mid-ocean instead of the Portsmouth waters, why need we have repined or murmured at her loss!

Considerations like the foregoing must have occurred at times to all of us. Yet there is such an ineradicable love of life in us, and such a dread of the suffering that commonly attends death, that we cannot satisfy ourselves without attempting to reduce those losses of life which are continually appalling us. No wonder, then, that means of lowering and disengaging boats rapidly from ships should have been a favourite subject of study to many minds for years past; for there is good reason to believe that nine out of ten of those who are annually drowned in and from ships might be saved by such means. It is not our present purpose to investigate closely what has been done of late years in connection with this subject. But there are present to our mind a few considerations which seem to require notice just now.

All the boat-lowering and boat-releasing inventions for which the public patronage is just now sought—sought, that is, with any considerable degree of commercial activity—are, so far as we know, three, viz., Mr. Clifford's, Captain Kynaston's, and Messrs. Wood and Rogers's, the last of which was described and illustrated in our pages so recently as the 12th inst. The order in which we have mentioned them is the order in which the three plans were successively brought forward. Now, apart altogether from the relative merits of these systems, there is something to be said of the time and manner of their introduction. Of all the fallacies of inventors—and some inventors cherish many fallacies—there is no more common one than that of over-estimating the commercial value of inventions. It is quite true that every week men are making fresh fortunes out of patented articles, often with but little aid from capitalists, or even from capital. But in the majority of cases an invention, however excellent intrinsically, and although patented, is perfectly worthless in the hands of a man who has neither capital nor the means of acquiring it. This is true even where the novelty has no opposition to cope with. But where an invention affecting vested interests in any unpleasant way is brought forward, no matter what its object may be, the work of carrying it out commercially is inconceivably great and burdensome.

Now, in the practical introduction of apparatus for lowering and releasing boats rapidly, enormous difficulties have been encountered. No language that we might here employ could in the least express the amount of lethargy—to say nothing of active opposition—which existed in reference to this subject when Mr. Clifford first sought to give effect to his proposals. The money, the labour, the time, the patience, the determination, the tact, the courage, which were needed, transcend infinitely the merit of producing an efficient apparatus for the purpose. The invention itself, however well contrived, is as nothing in comparison with the efforts expended upon its introduction. For these efforts, made zealously and most persistently, Mr. Clifford deserves, in our opinion, far greater credit than the most meritorious boat-lowering invention could of itself win. To him belongs, and from him cannot be taken, the honour of having not only demonstrated the practicability of saving life by a suitable apparatus, but also of having forced the fact upon the minds of shipowners, Emigration Boards, Admiralty Boards, and the universal public with such clearness and cogency that the captain who now goes to sea without some such apparatus renders himself liable to the reproach of being guilty of wantonly risking life, should a life be lost for the need of it. Indeed, we hope we shall soon see captains put upon their trial on charges of manslaughter should either seamen or passengers be lost where the sudden lowering and releasing of a boat could save them.

That Mr. Clifford has thus familiarized all minds with this great subject, and caused all to look for an efficient method of getting ships' boats speedily into the water in cases of emergency, is a clear proof of his fitness for the work he has undertaken. It is a mistake to suppose that he was unfamiliar with boats and boating when he began his great and humane work. He was long before known upon the Thames both as a skilful boatsman himself, and as a zealous cultivator of the art of boating in others. He for a long time took the lead in several movements which had the improvement of that art for their object. It is also due to him to say that his plan of lowering and releasing boats, which is now adopted in hundreds of vessels, and which has already saved scores upon scores of lives, was not taken up with haste. We have frequently in times past had opportunities of tracing the successive steps by which he arrived at that plan, and we must say that in his course he devised, tested, and abandoned many schemes which have since reappeared in other places. We state this simply to give him the credit—which is his just due—of not having lightly or inconsiderately sought the accomplishment of the great object he had in view. Moreover, we must add, had nothing higher than a mere pecuniary interest inspired him he would never have done what he has. It is a fallacy to suppose that any mere money-loving man, unless totally ignorant of the world and its ways, would ever turn to the invention of any such thing as a boat-lowering apparatus. It is a sadly fallen world this, and anything like a humane purpose is positively a bar to the adoption of any improvement whatever. A shipowner, in nine cases out of ten, would in reality far sooner effect a saving of one per cent. in his money outlay than 50 per cent. of the lives which he loses. Remembering this, and recollecting also that every apparatus for lowering and releasing boats in a novel way costs money, our readers will not think very highly of Mr. Clifford's pecuniary advantages in connection with his invention. We know, indeed, that many inventions that have not cost their authors a fiftieth part of the expense, time, and personal exertion that have fallen to Mr. Clifford's lot, are at this moment bringing in fifty times larger returns and profits than spring from his, notwithstanding the extent to which his plan is now adopted. We ought also to say that Mr. Clifford has not shrunk from even greater risks than mere money matters can involve in the furtherance of his design. For the sake of the lives of others he has, as we think, repeatedly risked his own, having often put his apparatus into operation with his own hands under circumstances in which no boat could have been lowered by ordinary means—descending from the ship's side in the roughest weather, and when the vessel has been steaming at her greatest speed.

Having thus attempted to do justice to Mr. Clifford's labours in this great question, we must now observe that, notwithstanding those labours, his invention must stand solely upon its merits, and be prepared, if it is to continue in favour, to compete freely with all others. We do not wish to imply that Mr. Clifford needs to be reminded of this fact. He has, so far as our knowledge of his proceedings goes, always avoided pleading his services, and based his claims upon the merit of his plan alone. In our own pages he has repeatedly avowed that this is the only position which he desires to assume. This is quite as it ought to be; and although it may appear hard that one man should sow, and a host of others rush in to reap the harvest, we are bound to adopt a better invention than Mr. Clifford's, should such be forthcoming.

Next to Mr. Clifford comes Captain Kynaston, C.B., to whom also seamen and the public are greatly indebted for his labours. Captain Kynaston is no imitator of Mr. Clifford, or of any one else. He came home wounded from the Russian war, and in the leisure which followed—if a period of acute and prolonged suffering may be called leisure—gave that professional attention to the subject which Mr. Clifford has continually invited. He speedily came to the conclusion—whether rightly or wrongly—that the method of placing both the lowering and the releasing of the boat in the hands of a single individual on board of her was an improper one; and accordingly set about devising a means of releasing the boat instantaneously after she had been lowered in the usual manner by the tackles by men on board the ship. This means is admirably provided in his disengaging hook, with its arrangement of lines or falls. Having succeeded in inventing this to his satisfaction, the gallant inventor proceeded to urge its adoption on his brother officers with aims as high, and motives as pure, we believe, as Mr. Clifford's. Standing well in his profession, and being personally known to many of its members, he has been far from unsuccessful. Our own columns have shown repeatedly how favourably his plan has been received, and what satisfaction it has given. Recently the Admiralty have given instructions for any captain or other officer in command who may desire to carry the apparatus to be furnished with it. His must be an ill-balanced mind indeed who does not take pleasure in its success. For our part, we most warmly and cordially congratulate Captain Kynaston—who is known to us as a most able man and gallant officer—upon the good result which his cares and labours in this matter have already brought about.

The last labourers in this noble work are Messrs. Wood and Rogers. The former of these gentlemen is an officer of the Peninsula and Oriental Company's ship China, who avows that increased efficiency and security in boat-releasing are his objects; the latter is an ex-

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perienced foreman of shipwrights in the dockyard of the Messrs. Green, at Blackwall. Our first impression of the plan was, we confess, not very favourable, for it happens that when we were ourselves benevolently contriving plans of our own for effecting this object eight or ten years ago (—we have not invented anything since, let it be understood—) we devised the precise arrangement adopted by Messrs. Wood and Rogers. We then rejected the plan, thinking the long bolts extending along the inside of the boat would be liable to be carried away by the rough usage to which boats are subjected, especially in times of emergency. But we are not disposed to insist upon this objection. Other persons, who are perfectly competent to pronounce an opinion upon the subject, do not urge it. Messrs. Money Wigram and Sons, for example, in writing on the subject, do not mention it, but tell us that the plan "appears to "possess the advantage of having no rope as "part of the disconnecting apparatus that could "kink in running out, and that after the gripes "are cast off, the boat hanging at the davits "would not cant from a person stepping on the "gunwale in getting in; and by having a spare "set of the spans to be attached in the boat, the "davit tackles can be hooked on immediately "on reaching the ship." Mr. Joseph Samuda also tells us that he has witnessed a trial of the apparatus, and that "it was in every way "satisfactory as regards the merits of the system."

On referring to our engravings of the 12th instant., the reader will see that Messrs. Wood and Rogers, like Captain Kynaston, lower by the tackles, and release the boat only with the special apparatus. Whether this plan is or is not superior to Mr. Clifford's can hardly, we think, be settled. It appears certain that by Mr. Clifford's system a boat can really be got into the water in a briefer space of time than on either of the other systems; but all can do it in a minute or two, and that may be all that is necessary. For ourselves, we refuse to speak definitively upon this point for the very simple and safe reason that no speech of ours—or, indeed, of any one's—can possibly be received as authoritative on such a subject. Some officers will always, doubtless, prefer to use the tackles in lowering; others will, as doubtless, prefer to dispense with them. It is properly their prerogative to decide the matter, and we willingly leave it to them.

One thing we ask, and one thing we must insist upon, viz., that when so many reliable contrivances for saving life at sea are to be had, shipowners shall not allow the lives of the public to be sacrificed for the want of them with impunity.

OUR RIVER DEFENCES.

Captain Cowper Phipps Coles, of Lady Nancy raft reputation, has thrown a few thoughts together into a printed paper with a view of aiding us in our present schemes for defending our coasts. As this officer takes a somewhat novel view of the subject, and as he brings experience of his own to bear upon it, an abstract of his views may be of service here. It is not invasion to any extent of which we have to be apprehensive, he thinks, but a flying squadron of fast gun-boats, and ships of moderate and light draught of water, that could, after evading our fleet either in a fog or by false intelligence, run up any of our rivers, capture or burn our shipping, and levy contributions upon helpless towns, such as those upon the Thames, the Humber, the Mersey, Tyne, or Clyde. It may be replied—The forts will stop them. His answer is—in these days of steam, when a vessel can go ten knots, with three knots' tide in her favour, they are incapable of doing so; at any rate, it would take years, and require enormous funds to construct sufficient forts for effectual protection. Moreover, the smoke of the first gun fired from these forts would blind all the others, particularly where any have more than one tier of guns. "Let me ask," he says, "what "chance have you of hitting a flying object "going thirteen knots? You are lucky even if "every gun gets a hurried flying shot at her, "which from the rate she is going at would, "unless very well judged, drop harmless into "the water astern of her, like an inexpert "sportsman who frightens a rabbit, or perhaps "tickles his tail."

Assuming that our navy may be called away, and our coasts be left for a short period to their own resources, we obviously require, he says, some means of rendering speedy and efficient protection to our wealthy mercantile ports, by means that shall readily be created, but be comparatively inexpensive, comprising the means of a rapid and vigorous expansion, in case of war, and only available for a given locality. The question is, in fact, how are we to protect these rivers and harbours against an enemy's flying squadron? In addition to our present means, Captain Coles suggests the placing of numerous detached guns afloat on each river, in shallow water, where sea-going ships could neither run over nor board them. From the experience he had with the Lady Nancy, at Taganrog, and other ports in the Sea of Azoff, he feels convinced that nothing has been hitherto invented that can excel a raft for the purpose of floating guns into shallow waters. The cost of a raft is but trifling (£100 each), this in itself being a great recommendation; further, it is easily constructed, and possesses great strength, durability, and buoyancy; it also draws but little water, and being made of casks, comprises, as it were, so many water-tight compartments. From this last cause, combined with its lowness, and the small object it would present to an enemy, he believes it would be impossible to sink a raft. "I can testify," he says, "that rafts of such a "construction give a most steady platform, with "the great advantage of ricochet firing, and the "concussion of the gun does not in any degree "affect the casks or the structure, which, if "damaged by shot, can easily be replaced or "repaired."

It may be said, If you want to float a number of guns, why not take up all the small steamers, lighters, barges, and other such craft? To these there are, Captain Coles considers, great and manifest objections. They possess none of the powers of endurance against shot that a raft has, besides being immeasurably more costly in their construction; they are likewise less buoyant, and consequently are less capable of navigating shoal water, and present a larger and more defined object to an enemy's guns. Further, as such vessels are not fitted for guns, you would first have to fit them by strengthening their decks, shoring them up, &c.; the masts, too, are badly placed and in the way of the gun. Such craft are also of different sizes, and therefore would each require different fittings, and when complete, and the guns put in, the concussion of firing would start all the caulking, and so strain their timbers that you would at once have a leaky vessel, which would either sink herself, or, when under fire, being in only one compartment, would be sent by the very first shot to the bottom. A raft could be built quicker than one of those vessels could be even caulked, much less fitted to carry a heavy gun.

The cross fire of any number of rafts, when placed in shallow water, and possessing the means of readily altering their positions, no vessel could escape. But boats will board them, it may be said. In reply to this objection Captain Coles says:—"The success of the "attacking vessels depends upon their speed. "To lower and man boats they must stop, "when the cross fire of these numerous rafts "would most likely prevent the boats leaving "their ships at all." It may again be said, they will tow their boats with the men in them already to make a dash. But, "they cannot "tow boats fast for fear of swamping them; "besides, if they are hit and swamped with a "number of men in them, it would cause great "confusion, which would be increased every "moment she was stationary, by the cross fire "on her."

So much for what may be called the theory of the subject. As to practice we are told by our gallant author that, having already tried and accomplished it, he will guarantee, with a gun's crew, four shipwrights, and a cooper, to put together in twelve hours a raft that will carry a gun of the heaviest calibre. He even gives us the very names and qualities of the materials required for the purpose:—

"All the materials that it requires is, 300 "fathoms of rope (rounding), 30 butts, or a "greater number of smaller casks, in proportion; 14 fir poles, 45 feet; 24 poles, 20 feet, "or a greater number of smaller ones; and 100 "feet of 3-inch planking, 2 anchors, hawsers, "warp lines, &c. Gun and carriage, with 100 "rounds of ammunition, when she will only "draw two feet of water." His mode of putting a raft together is so secure, and at the same time so simple, that any sea-faring people could be taught, he believes, to construct them with great ease, and any one having seen a model, with a little explanation, would be able to build one.

It may not be out of place here to explain how Captain Coles would make these rafts available, and organize them as a regular system of defence for our maritime ports and towns, and wherever there is shallow water. At such places, during peace, he would have established an officer and gun's crew of gunners, instructed in building these rafts. It would be their duty to build one or more, on which guns would be mounted, and to teach any number of volunteers who could be induced to learn the gun drill and to build the raft. With a little encouragement, all the population connected with shipping, such as boatmen, piermen, lightermen, and shipwrights, would, it is thought, willingly give up a certain time to this for a slight remuneration at the expense of the town to be protected. By having a large number of these men taught and trained, you could man any number of guns, having in each an experienced gunner for captain. In case of our shores being threatened, or any emergency arising, swarms of those rafts would spring out of every river and creek, the Government merely finding the guns and ammunition, of which a store should be kept near a pier, where each raft could arm as fast as it was built. The numerous tugs would then tow them into position to the shallow waters of our rivers, which "in a miraculously short space of "time would be literally lined, as well as "thoroughly defended." These rafts being by comparison almost inexpensive, and at every port at once offering a self-created defence, our men would be organized and told off into regular guns' crews, and with a little tact and practice a healthy emulation would be evoked, strengthened, and perpetuated; so that in the event of a war, we should have a most effective body of floating coast artillerymen at all times ready for service on their own coast. The possession of such a force would give assured

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confidence to the country and discouragement to the designs of an enemy.

So many considerations come in to check one's approbation of plans like this, that we do not think it wise to pronounce at once in favour of the adoption of these proposals to any great extent. But we are quite prepared to ask with Captain Coles,—Is it not at all events worth while to try a few of those rafts, to show what capabilities and powers they possess? If they fail, the expense is trifling; if they succeed, how cheaply we can augment our protection in case of war!

THE PURIFICATION OF THE SERPENTINE.

The plan proposed by Mr. Hawkesley and adopted by Mr. Fitzroy for improving the condition of the long pond in Hyde Park and Kensington Gardens—yclept, on the *lucus a non lucendo* principle, the Serpentine River—appears to have met with unqualified disapprobation from the public press and the greater portion of the engineering profession. On the other side, however, we have the names of Mr. Robert Stephenson and Mr. T. Spencer; and the analytical experiments of the latter gentleman are certainly not without weight in favour of Mr. Hawkesley's scheme. This scheme consists in drawing about 2,000,000 gallons of water daily from the lower end of the lake, and throwing the same, when freed from mechanical impurities, into the upper end in the form of a cascade. The effect of this flow of aërated water would be to oxidise the soluble organic matter that nourishes the growth of the *confervæ* and slimy vegetation, which are so detrimental to the appearance of our ornamental sheets of water. It is not, therefore, upon the filtering process alone that we are to depend for the removal of objectionable impurities, and for the attainment of a comparative degree of limpidity. The stagnant vegetation is to be attacked both by natural and by artificial means; since the former cannot wholly be adopted. The importance of the "cascade" during the prevalence of close and dry weather is not easily to be overrated. The chemist can testify to the danger which would be incurred, even in the absence of sulphur and phosphorus from the dissolved organic matter, by removing the living vegetations in whose growth this is absorbed, without at the same time supplying nature's great purifier, oxygen, to obviate chemical changes of a more dangerous character than the conversion of this organic matter into carbonic acid gas. And although it may be observed that this gas is one of the principal supporters of vegetable life, yet the plants which thrive in aërated water are of a very different class to those which grow so freely in a semi-putrid and stagnant compound of decayed vegetable and animal matter.

The necessity both of filtration and aëration is strongly exemplified in the present condition of the lake in St. James's Park. The process there adopted is characterised by the *Times* writer, who so strongly repudiates Mr. Hawkesley's plan, as a "complete success." But surely this gentleman cannot himself have verified the condition of this piece of water, or the expressions "clear" and "limpid" must be intended as ironical. We leave the question of their applicability to any of our readers who have an opportunity of viewing the result of the experiment by which this lake has been rendered so completely artificial. Unless much wind or rain shall have intervened, they will find the greater part of it covered with a thick and apparently solid slime—a crust supporting multitudinous light bodies; while throughout its whole extent the flocculent *confervæ* arrest the sun's rays before their warmth can be absorbed by the solid concrete below. Upon this concrete the vegetations will ultimately be deposited in the form of mud.

Much stress is laid by the advocates of the system adopted by Messrs. Easton, Amos, and Co., in the St. James's Park water, upon the nuisance likely to arise from the filtering apparatus to be established at the upper end of the Serpentine. But if any such nuisance occurs it must be from gross negligence or want of skill. The matters to be separated are neither poisonous nor rapidly putrescent. The mud at the bottom of the Serpentine is, as we are assured by Mr. Spencer, very different from the Thames slime, the offensiveness of which is owning to a black substance composed of sulphur, carbon, and iron, of which no trace is found in the lake. Choleic acid from bile, and sulphuretted hydrogen evolved from sewage matter, are also absent. Indeed, the impurity of the Serpentine water has been much exaggerated, despite the occasional overflow into it of the contents of the Ranelagh sewer—evidenced at rare intervals by the presence of *paramecia* and *vibriones*. Its offensiveness is simply that of ordinary stagnant water, arising from decaying vegetation, and is far more perceptible to the eye than to the organ of smell. To remove this water, amounting to 60,000,000 of gallons, and to replace it by a similar quantity exposed to the same conditions of stagnation, would be an evident absurdity; and the formation of a shallow artificial bottom of concrete is, in our opinion, not likely to improve its quality. The depth of water in the Serpentine is an advantage the result of which in preventing the most objectionable forms of vegetation has been generally overlooked; and the carbonaceous bottom would probably be but ill replaced by a concrete, the deposit upon which would ferment in the direct rays of the sun.

With regard to the filtering process it may be observed that the method to be adopted will be similar to that in use at the Glasgow Gorbals Water-works, and other establishments of the same nature. The simplicity and efficacy of this method have been fully tested. The water is discharged from the conduit on the top of a compartment of gravel, through which, by means of an aperture at the bottom, it passes into a well adjoining. The overflow from this then runs into coarse sand, and in a similar manner into fine sand, before it is ultimately discharged. In the case in point there will, for convenience of cleansing, be two such filtering contrivances; and one or more of the stages of purification may probably be dispensed with.

To remove the impression which appears to prevail that the water in the Serpentine approximates in its characters to that of the Thames, it would suffice to examine comparatively the deposits of lime on the margin of the lake and on the banks of the river. That from the latter will be found soon to evolve its noxious constituents; while the lime deposit from the Serpentine is wholly inoffensive. In both cases the addition of lime is of very questionable utility. In the Serpentine especially, though it destroys the *confervæ*, together with the animalcules and the fishes, it cannot prevent their putrefaction, or remove its products. When the plan of Mr. Hawkesley shall have been carried out, we hope that these organisms will be left to fulfil, under more favourable conditions, their due purposes in the economy of nature, and that the Serpentine, when restocked with fish, may afford, as of old, a harmless amusement to the piscatorial enthusiasts of London.

THE MAIN DRAINAGE SCHEME.

The ground which we take in decrying the main drainage scheme is, we think, perfectly open to us. The greatest chemists in the world tell us that the soil must be replenished, either by the waste portions of human food, or by some substitute for it; and we know perfectly well that the use of guano, and other artificial modes of restoring the soil's energies, are very costly. We know further that no mechanical impediments prevent us from returning to the land that with which we at present pollute our beautiful and noble river. Why then, we ask, with these facts before us—why are we spending millions of pounds sterling on a scheme which is designed still to deprive the land of that which it so much needs, only to pour it into a river that refuses even to absorb it uselessly!

In our number of the 12th of August, we devoted a column or two to the repetition of this question, and by doing so have brought down upon us the rebuke of a journal which, as it is both temperately and ably conducted, has a perfect right to speak upon this or any other great public question. It is the *South London Local Journal*—which circulates freely from Richmond to Woolwich, and from Southwark to Croydon, and even beyond these limits—that has, not undeftly, parried the blow aimed at the Board of Works. To show that he is not unfriendly to us in the main, our antagonist thus commences his remarks upon our article:—

"We regret to see that the mania against the "Board is not confined to the less influential "portions of the press. Our excellent contem-"porary, the Mechanics' Magazine, in its is-"sue of last week, contains an article which in-"veighs against the Metropolitan Board without "one word of qualification. The increasing re-"putation of this well-conducted Magazine, "gives peculiar weight to its advocacy or oppo-"sition. The public principally owe to it some "important reforms of recent date, and will "probably be indebted to it for several more. "If this one organ had defended the upper "Board against its opponents, we should have "felt that public opinion was likely to receive a "salutary influence in an important quarter. "But the editors of the Magazine in question "are fully equal to their contemporaries in the "weight of their denunciation." After this flattering commencement, we were not, of course, to be rebuked with bated breath. Hence, we read:—"It may sound very well for a "scientific periodical to rail at the Board "for not utilizing the sewage, but the "Board in return may complain that while "science talks of the value of the sewage, no "practicable method has yet been devised by "which the value can be realised. The waters "of the sea may hold silver in solution, but by "what process are we to extract it at a com-"mercial profit? The theory may be excellent, "but where is the practical method? The "Metropolitan Board is not a conclave of en-"gineers. All they can do is to take advantage "of the scientific talent of the day. But where "is the plan which provides for the accomplish-"ment of that which the foregoing extract de-"mands of the upper Board? We candidly "confess that we once advocated a plan different "from that of Mr. Bazalgette, but in so doing "we abstained from condemning the scheme "of the upper Board. Our argument then "amounted to this—that while Mr. Bazalgette's "plan might answer the purpose, there was a "cheaper method which might be less complete, "but which would be also less expensive, and "which would accomplish all that was really "required. No such moderate opposition will "satisfy the present temper of our contempo-

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"raries in general and the Mechanics' Maga-"zine in particular."

Now, we are not in the least angry with our friendly contemporary for saying all this; but we desire, nevertheless, to show in a few words that he is scarcely fair to us in his observations. In the first place, although we claim the right to speak occasionally of an evil without pointing out in every case the remedy, it happens that in the article criticised we were not dumb on this head. We referred, for example, to what is going on at Paris. We stated that the intercepting sewers on either side of the Seine are already finished, and that arrangements are in progress for deodorising their contents, which are to be applied to the land, as they ought to be. We also referred to the plans of Mr. F. O. Ward and Mr. G. Coode; and we then contended, as we are prepared to contend again now, that it is not from want of knowledge that the Main Drainage Scheme is allowed to be carried into effect.

In the next place we have been, and are, content with that "moderate opposition" for which our contemporary asks. Our position is precisely that which he confesses he once took, for we merely advocate plans different from that of Mr. Bazalgette without "condemning the "scheme of the upper Board"—without condemning it, that is, in any other way than that of opposing the waste of agricultural material which it involves. And surely no intelligent writer can refuse to condemn the plan to this extent; certainly the able editor of the *South London Local Journal* cannot avoid so natural an act. We do not deny that Mr. Bazalgette's system will relieve London of most of the poisonous cloud which now rises visibly and tangibly from the foul stream that creeps through it. But we do lament that a mode of relief has been adopted which will do nothing towards the other great ends to which the finger of science has for a long period been pointing, and which, with our present expenditure, might certainly have been attained.

WORKING MEN'S POETRY BY THE POET LAUREATE.

Machinery is the chief subject of these pages; a great subject; grand as Nature herself. The first thought of the inventor of a machine is an inspiration, akin to the first thought of the Maker when He planned the organism of the tree or the animal. The same subtle forethoughts, provisions, checks and counterchecks, that entered into the construction of the animal organism enter into the construction of a machine. The laws that enter into the working of a machine are the laws that penetrate Nature's framework. The uses and ends of machinery are a farther development and extension of Nature's aims and ends. The stroke of the hammer, the throb of the engine, the plash of the steam-ship's paddlewheels, make music as true as the beat of the heart, the murmur of the ocean tides, or the song of the morning stars singing together for joy.

This will not sound as rhapsody to those who have really thought about human activities and human civilisation. But great as machinery is, surely the man working the machine is greater. We conceive that especially he, the manual labourer, the mechanic, ought to be a subject of prominent interest in these pages; and that if at any time we dwell on what is peculiar to his condition, and especially on what helps him to realise his manhood, as apart from and superior to his condition, our readers will thank and not blame us.

Reading the other day—as thousands of the best in England and elsewhere have been doing—Tennyson's "Idylls of the King," and feeling throughout how emphatically an every man's book it is, we determined to make it the subject of a few thoughts on poetry and the working man, or rather literature as belonging to man as man. Books form quite a world by themselves. Seen from our rough, actual world, they are as a celestial city, a city in the air—like that which John of Patmos saw. As in modern Rome, in the common street or shop, some column, or arch, or niche of old Roman fabric looks out on you and reminds you of grander men and times, so from the shelves of our common walls do books look out on and admonish us. All that makes up the solid real world is in the world of literature, but transfigured and glorified. There is the outer life of man there, real, as it is; but all interpreted by the light of the ideal—the light of man's highest aims and desires. There is the inner working of the mind of man there; but of man at his best—the ideal, the true man.

As an example of this high ideal character of true literature, observe the absence in it of all the stigmas and badges of conventionality by which men are labelled in actual life. It deals only in things that have an intrinsic, universally human interest. It does not belong to the rich man or the poor man, the prince or peasant, but to all of these. It sets value only on man as man. It treats of the constituent parts of human nature; of its inborn attributes. It treats of the whole range of universal human existence: of birth, death, youth, maiden, man, woman, infancy, and old age; of work and manners, love and hate, hope, struggle, disappointment, tears of agony, tears of rapture.

If this universality be the test of admission into the commonwealth of literature, then the writings of Tennyson take rank among the highest there. The choice of the subject of his new Poem—the English Knighthood of the Middle Ages—arose out of the Poet's excessive manliness. Here is another child of nature, in an over-civilised time, sighing after the earlier, simpler, more primitive ages. Every stage of healthy development has doubtless its own virtues and beauties. Childhood is so uniquely beautiful that we would fain arrest its growth and fix it as it is. The man smiles at the follies of his youth, but what would he give to bring back the fulness of its energy and joy. It is so in the growth of the human race. Who does not exult at the achievements of civilisation—our noble human dwellings, enriched with the products of every zone; our rapid intercommunications of city with city, nation with nation; our social refinements and charities; our social and civic organisms and liberties; our accumulated wealth of things material and things mental, contributed by the genius of every place and time. But amidst all this gain, how much has been lost? Waited on everywhere and in everything, we lose our energy. The policeman protects us at home, the soldier abroad; and we are afraid of pain or the sight of blood, of risk or danger. But what is worst of all, we are infinitely afraid of this thing we glory in—civilised society. Like a fly with a thousand eyes, each watches society on every side—what does it think of me?—of my house, furniture, dress, manners? what of my opinions, about the mind within me and the eternity behind and before me? Thus are energy, self-reliance, self-help, and daring forfeited for our civilisation. This thought preys like a sickness upon our noblest men. This drove the great Goethe to reproduce the rude, self-helping "Goetz with the Iron Hand," and this we fancy has led our Tennyson to "The Knights of the Table Round."

The language of this book is the pure, crisp Saxon mother-tongue of us all. The natural scenery described in it is plain English scenery, such as lies close to our own doors. Bodily strength and prowess are revelled in here;—the "knotted column" of the warrior's throat,—

> "The massive square of his heroic breast,
> And arms on which the standing muscle sloped,
> As slopes a wild brook o'er a little stone,
> Running too vehemently to break upon it."

Here are natural beauty of face and figure, which are as thick sown amongst the poor as the rich; and more, as the poor far outnumber the rich. Constitutional bent is hinted at as the mysterious ineradicable source of all nobleness or baseness:—

> "The world will not believe a man repents:
> And this wise world of ours is mainly right.
> Full seldom *does* a man repent, or use
> Both grace and will to pick the vicious quitch
> Of blood and custom wholly out of him,
> And make all clean, and plant himself afresh."

Manners are a great subject of the "Idylls, as always with this poet. He is a great worshipper of all that is high-minded, chivalrous, dignified, sweet, and graceful. His stately, heroic soul loathes the meannesses and paltrinesses of his time. He has not lived in vain, if only for the beautiful manners he has taught us. But the manners he teaches are not those of the boarding-school and drawing-room; but the natural, necessary outflowings of a high and beautiful mind:—

> "For manners are not idle, but the fruit
> Of loyal nature, and of noble mind."

There is one element that perhaps more than any other divides the great from the humble in society, which he singles out and deals his sharpest strokes upon, and that is—scorn. For example, of Lancelot at the homely castle of Astolat, he says:—

> "Then the great knight, the darling of the court,
> Loved of the loveliest, into that rude hall
> Stept with all grace, and not with half disdain
> Hid under grace, as in a smaller time,
> But kindly man moving among his kind."

And again—

> . . . . . "in those days
> No knight of Arthur's noblest dealt in scorn;
> But, if a man were halt or hunch'd, in him
> By those whom God had made full-limb'd and tall,
> Scorn was allowed as part of his defect,
> And he was answer'd softly by the King
> And all his Table."

There is a great deal about poverty and riches in this book. No shame belongs to "honest "poverty" here. Perhaps the best thing in the book is the story of a house of broken fortunes which Geraint, a Knight of the Table Round, lights accidentally upon. Geraint rides up to this castle in decay:—

> "There musing sat the hoary-headed Earl,
> (His dress a suit of fray'd magnificence,
> Once fit for feasts of ceremony) and said:
> 'Whither, fair son?' to whom Geraint replied,
> 'O friend, I seek a harbourage for the night.'
> Then Yniol, 'Enter therefore and partake
> The slender entertainment of a house
> Once rich, now poor, but ever open-door'd.'"

While waiting in the castle court, the voice of Enid, Yniol's daughter, rings clear through the open casement of the hall, singing:—

> "It chanced the song that Enid sang was one
> Of Fortune and her wheel, and Enid sang:
>
> "'Turn, Fortune, turn thy wheel and lower the proud;
> Turn thy wild wheel thro' sunshine, storm, and cloud;
> Thy wheel and thee we neither love nor hate.
>
> "'Turn, Fortune, turn thy wheel with smile or frown;
> With that wild wheel we go not up or down;
> Our hoard is little, but our hearts are great.
>
> "'Smile and we smile, the lords of many lands;
> Frown and we smile, the lords of our own hands;
> For man is man and master of his fate.
>
> "'Turn, turn thy wheel above the staring crowd;
> Thy wheel and thou are shadows in the cloud;
> Thy wheel and thee we neither love nor hate.'"

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We dare not comment on this song, sung thus amidst ruined fortunes. To us it is as wild and grand as the old Greek legend of Prometheus on his rock. It utters for us the one grand distinction between the little and great,—the noble and the ignoble, the worldlings and the religious of mankind.

Geraint, entering the decayed hall, found the aged mother in "dim brocade," and near her Enid, "in faded silk," looking out (says the poet in one of the purest outbreaks of the imaginative power) from amidst this ruined house, and aged, faded parents,—

> . . . . . "like a blossom vermeil-white,
> That lightly breaks a faded flower-sheath."

She discharges for Geraint the services that look strange to us in a lady. But she knew that whatsoever is fit for human hands to do can never degrade the hands of any door of it, be they a lady's or a servant's. She took Geraint's charger to the stall, and gave him corn; went to the town to buy flesh and wine;—

> "And then, because their hall must also serve
> For kitchen, boil'd the flesh, and spread the board,
> And stood behind, and waited on the three."

Geraint, before he had seen her, while listening to her song had said to himself,—

> "'Here, by God's grace, is the one voice for me.'"

And seeing her so sweet and serviceable, and letting his eye follow her, or rest on her at her lowly handmaid-work, he longed to make her his true wife, and before the night was spent petitioned Yniol for her. Then the heart of the old man, who, whatever evil happened to him, "seemed to suffer nothing, heart or limb, "but could endure it all most patiently,"—

> "Then, howsoever patient, Yniol's heart
> Danced in his bosom, seeing better days."

Tennyson has never been poor, but you might think he had from these scenes. Goethe, who never was poor, makes one who was so say, "The fortunate man does not believe that "miracles still happen; for only in misery does "one discern God's hand and finger, which leads "good men to the good." Only he who has been at his uttermost, in mind, body, or estate, has felt his heart run over with trembling joy and gratefulness.

And Geraint wishes Enid to go with him to Arthur's court in the faded silk she wore when he saw her. And Guinevere, Arthur's Queen, who had said to him,—

> "'But ere you wed with any, bring your bride,
> And I, were she the daughter of a king,
> Yea, tho' she were a beggar from the hedge,
> Will clothe her for her bridals like the sun,'"—

met them at the gates, embraced Enid with all welcome as a friend,

> "And did her honour as the prince's bride,
> And clothed her for her bridals like the sun."

THE GREAT EASTERN.

In a speech made at the general meeting of the shareholders of the Great Ship Company, Mr. Jackson, M.P., made the following remarks respecting the recent completion of this noble vessel:—"Bearing in mind," he said, that "Mr. Scott Russell had the completion of the great engine in his hands, and that no other man could have finished it, they were therefore in his hands, but they sent for Mr. Russell and, after great doubts and great deliberation, it was agreed that he should have the work, on condition that the contract should be taken in block; that the pattern card should be the Cunard line packets and the Royal Mail Company's vessels, that the ship should be fitted for 800 passengers only at first, and that the internal fittings should be subject to the approbation of Mr. Robert Macalmont, who kindly undertook to superintend that part of the work. He (Mr. Jackson) then said they must have abundant security for the performance of the contract. Well, they had the security of Mr. George Wilde that the contract should be duly executed, and they had a reference to three referees of the highest authority, with that of Mr. Macalmont, for the internal fittings. And now, instead of the work occupying six months, as Mr. Brunel anticipated, it had been completed in four months, during which time as much work had been done as was required in building a 120-gun ship. He said if any man retrieved a position, and came out gloriously, it was Scott Russell. The work that he had done was incredible. Such an example of what could be effected by the combination of mind and muscle was unsurpassed. The pattern-card, as he had said, were the ships of those two great companies, and they had the reference to the three men he had named to them, with Mr. Macalmont, for the internal fittings, as to whether the work had been properly performed. Not an hour had been lost upon the work; every precaution had been taken. They brought their capital within a few thousand of what they had told them would be required for the completion of the ship, and it was his belief that if they had put the work in any other hands the ship would not have been ready for sea till next spring, and that she would not have come out under £150,000. Their efforts had been hourly and daily exerted for the success of the undertaking. Their chairman even slept on board. He had never seen a man so devoted to an object as Mr. Campbell was to that. He had no children, and he made the ship his child. His efforts were as untiring, and his zeal as strong as ever, and soon he would see his zeal repaid in the success of the ship. He (Mr. Jackson) was now separated from his wife and family at a time when he looked for recreation, after six months' attendance in Parliament, for having accepted a duty he felt he ought to go through with it. But he should be glad when he was able to withdraw, and it would be a proud day when he saw the ship go to sea, and could feel, with his colleagues, that they had done that which others had failed in doing."

Law Case.

ERMEN'S PATENT FOR POLISHING COTTON THREADS.
Northern Circuit, Liverpool, Aug. 19.

CIVIL COURT.—(*Before Mr. Justice* HILL *and Special Juries.*)

ERMEN *v.* LIDDLE.

Mr. Wilde, Q.C., Mr. Webster, and Mr. Theodore Aston were counsel for the plaintiff; Mr. Edwin James, Q.C., and Mr. Hindmarch for the defendant.

This was an action for the infringement of a patent for polishing cotton threads by the application of friction to the threads when in the hank, and while in a state of tension, by means of brushes. The defendant, by his pleas, denied the infringement, and also alleged that the plaintiff's invention was not new, that it was not properly described in the specification, and that it was not properly the subject of a patent. The plaintiff is a manufacturer at Eccles. His machine effected its object by passing the hank (which had been previously dipped in size and squeezed) over two rollers, which were turned with considerable velocity. Against the hank, thus distended and revolving, a cylinder, armed with brushes, and turned with a much greater velocity than the hank, sharply brushed. The effect was to make those threads which had slight excrescences to twist and gradually to absorb into their whole length the excrescences. A high polish was given to all the threads, which also became by the heat of the friction perfectly dry. The polished thread thus produced was easier to sew with, and when worked up with a little silk make a very fine silk-fabric, equal in appearance to a fabric containing 20 or 30 per cent. more silk, but in which ordinary unpolished cotton was used. On the 8th of this month the plaintiff and his attorney inspected under a judge's order, the defendant's mill at Middleton. Two machines were first shown to them, identical in principle with the plaintiff's, and the only difference in detail being that there were, instead of one, two sets of rollers on which the thread was spread, and that teazles were used instead of brushes. Afterwards several other machines were shown by the defendant, in which brushes like those of the plaintiff were used. Notice had been given by the defendant of three or four patents for the same invention as the plaintiff's, but these, it was contended, were essentially different.

For the plaintiff, Mr. Fothergill, the engineer, and several other witnesses were called, by whose evidence it appeared that the chief merit of the plaintiff's machine was its high velocity and great friction applied to the thread, which thereby became very compact and bright, and greatly resembled silk.

Mr. James, for the defence, contended that, although the plaintiff's machine might be more complete and effective than any other, particularly in the speed with which the brush cylinder was made to revolve, yet that, so far as the principle of his invention was described and claimed in his specification, which was the brushing of distended hanks of cotton thread, so as to render it smooth and polished, such invention was not new, but had been long previously to his patent known and used. The learned counsel called Mr. Ireland and several other witnesses, who spoke to having used so far back as 1823 a ruder machine than the plaintiff's, but which did polish by means of brushes fixed to a cylinder hanks of cotton thread distended on rollers. A model of this old machine was produced, but it appeared to have been only recently made from the description of some old persons who remembered the machine.

Mr. Wilde having replied,

His Lordship summed up, and left the jury to decide,—1, Whether the invention was new; 2, Whether the plaintiff was the true and first inventor; 3, Whether the specification was sufficient. The infringement was admitted by the defendant's counsel. Upon the plea that the invention was not the proper subject-matter for a patent, his Lordship should direct a verdict for the plaintiff. The learned judge thought that the defence rested mainly upon the evidence given as to the prior use of Ireland's machine; but the proof of its nature depended mainly on the accuracy of the memory of an old witness as to what he saw when he was a boy. The machines which had been previously patented were different from the plaintiff's.

The jury, without retiring from the box, gave a verdict for the plaintiff, thus establishing the validity of the patent.

Captain George A. Halstead, R.N., Secretary at Lloyd's, attended on Saturday at the Underwriters'-offices, in the Royal Exchange, and witnessed a trial of Mr. Ward's Ocean Marine Telegraph, recently tested at Woolwich Dockyard, and ordered to be adopted in the Royal Navy. The experiments, which were highly satisfactory, were terminated by the inventor announcing to the meeting his having received the satisfactory information from America, since his arrival in this country, that the Ocean Signal Telegraph, as then exhibited, had been approved by the New York Chamber of Commerce, and, consequently, adopted by the American navy exclusively.

The Great Eastern Steamship is expected to leave Portland, near Weymouth, on her trial trip, about the 8th proximo, and will return to Holyhead. First-class passengers only will be taken. Tickets, £6, £8, and £10, according to cabin, including provisions, are being issued at the offices of the Great Ship Company, King William-street. The ship is appointed to leave Holyhead, for Portland, U. S., on the 15th September. First class passengers only will be taken on this occasion also. Passage-money (including steward's fee and provisions) £18 to £25; state cabins extra. Return tickets will be granted on liberal terms.

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LAYING-OFF;
OR,
THE GEOMETRY OF SHIPBUILDING.

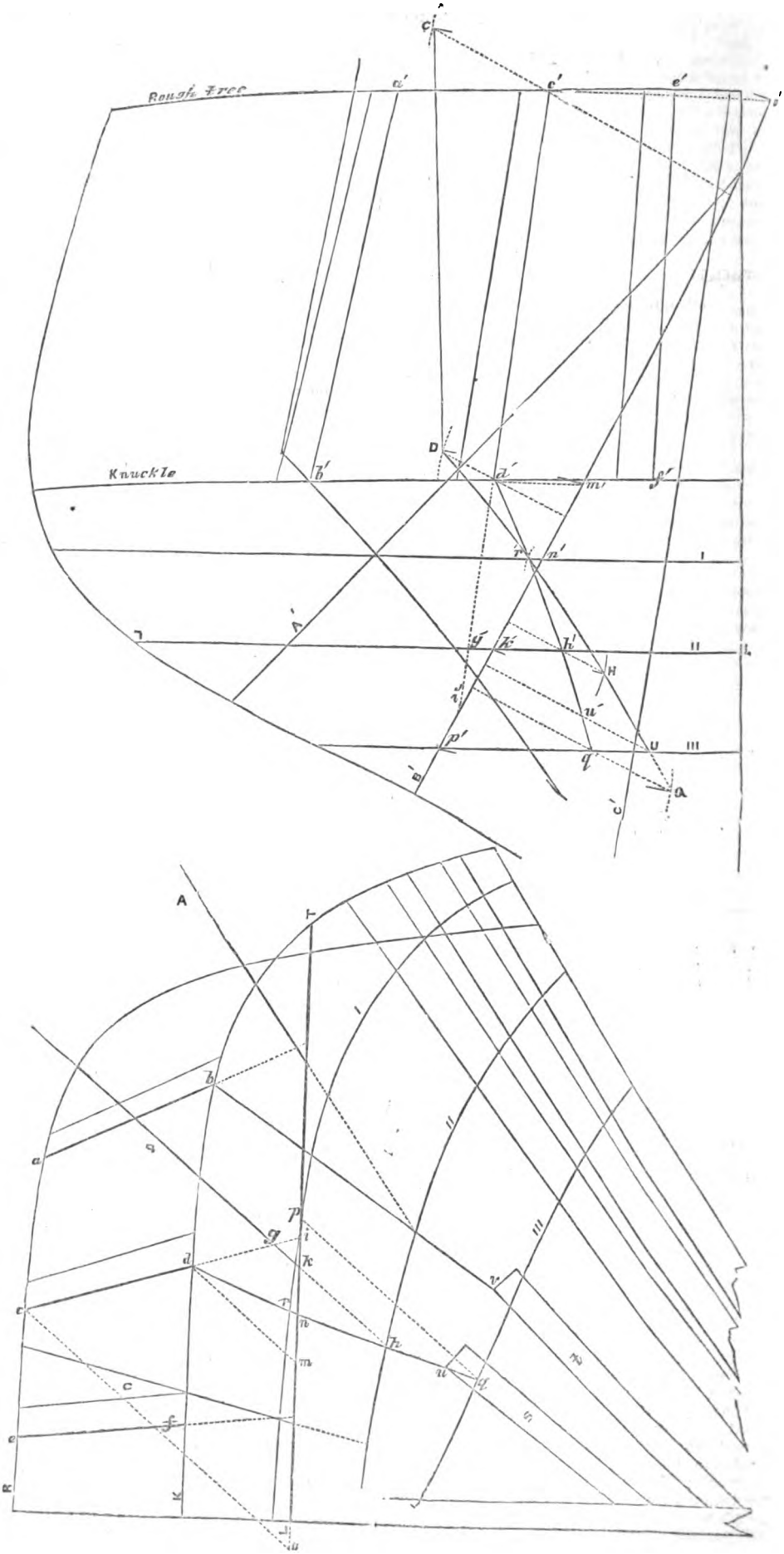
No. VII.

STERN TIMBERS.

We have seen that the cant timbers extend downwards to the deadwood, which being an integral part of the mass of timber running throughout the length of the ship, and forming, as it were, its backbone, offers a firm foundation for them, and is capable of receiving good bolt fastening through their heels. A considerable opening is left between these timbers at the heads or upper ends, but the length of the surface of the ship is so much reduced below, that it is necessary, in order to allow them all to run down to the bearding line, not only to bring their sides in contact with each other at their heels, but to narrow them considerably. By this means a heeling can be obtained on the deadwood and apron for all the timbers in the fore cant body. But the number and direction of the timbers required to form the stern make it impossible to do this in the after body. The cant timbers are therefore worked as far aft as is convenient, and the remainder of the stern is formed in another way by what are called *stern timbers*.

In the old square-sterned ships, the interval between the last cant timber and the stern-post was framed, below the load water-line, by means of horizontal cross timbers called *transoms*, and beneath them by short vertical chocks. The aftermost cant timber, to which the arms of all the transoms were attached, was called the *fashion-timber*. Resting upon the upper or wing-transom, and against the after-side of the fashion-timber there was another timber which extended up to the gunwale of the ship and formed the angle between the stern and the quarter; this was the outer stern timber, and was known as the *side counter timber*. The space between it and the fashion-timber was occupied by short vertical timbers stepping upon the side of the former timber; and the stern itself was framed by timbers with straight sides stepping on the wing transom and extending up to the gunwale. Under this system of construction all the external planking of the sides and bottom terminated in rabbets at the side counter timber and the wing transom.

The main characteristic of the modern elliptical sterns is the continuance of the planking of the sides quite round the stern, so that there is in them nothing corresponding to the side counter timber. All the timbers abaft the last cant timber which runs up from the deadwood to the gunwale, are called stern timbers. They differ from the cant timbers in this important particular, that whereas the latter are always vertical, the stern timbers are always inclined inwards at the head, so that the planes of their sides never cut the sheer plane in vertical lines as those of the cants do. The amount of this inclination is determined by that of the sides of the ship called the "tumble home;" the necessity for it arises from a regard to the appearance of the stern windows or lights when viewed from aft. If, while the sides of the ship are seen to incline inwards as they rise, the lights were vertical, and the upper ones as broad as those below, the effect would be very disagreeable. All the timbers framing these lights are therefore made to incline more and more as they leave the middle line (where they are upright), until they reach the sides where they have the "tumble home" of that portion of the side. By graduating the inclination in this way all the sight lines of the timbers, and therefore the sides of the lights, appear to be directed to one point above the stern. At the base of the stern there is a curved line called the *knuckle*, formed by the intersection of the upper portion of the stern and the buttock. At this line the after-ends of the plank of bottom terminate, all the plank above it being bent round the curve. It is generally situated at the height of one of the decks, and its projection in the body plan coincides with that of the upper surface of the beams on that deck. Its horizontal projection is not strictly elliptical, but



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it approximates to that shape. Its curvature is determined by the constructor with regard to the required fulness of the after-part of the deck. The knuckle line forms, as we have said, the base of the stern, which is strictly a conical surface—this line being the directrix. The fixed point through which the generating lines are to pass is at the height required to give the inclination of the lights just spoken of, and it lies also in the prolongation of the line defining the rake of the stern, or of the after-boundary of the sheer plan. The point thus found is the vertex of the cone which envelopes the stern.

Those portions of the outer edges of the stern timbers which lie above the knuckle, and in the conical surface, are straight; and their projections on both the planes of projection are, therefore, straight lines, but below the cone they follow the contour of the buttock. As the planes in which the sides of these timbers lie pass through the vertex of the cone, they are necessarily inclined to the horizontal plane, and the *horizontal* projections of the curved portions of the edges of the timbers will therefore be curved. If these inclined planes are parallel to the axis, as they are in some cases, the vertical projections of the curved portions of the edges upon the body plan will be straight lines—continuations, in fact, of the projections of the upper parts; but, if the planes cant inwards, then the projections upon the body plan, as well as upon the half-breadth, are curved below the knuckle. The former of these cases but rarely occurs. When it does, the mode of finding the true shape is very simple. Draw in the body plan, in the required position, a straight line, leading up to the vertex of the cone, and cutting the level lines below the knuckle. Measure the distances of its points of intersection with the sheer lines and level lines from the middle line, and set them off in the half-breadth on the corresponding lines, by which means the horizontal projection may be obtained. Then square up these same points into the sheer, and obtain on that plane another vertical projection of the moulding edge of the timber. Now, suppose the plane containing this moulding edge to be swung round a horizontal and fore-and-aft line passing through the knuckle until the plane is parallel to the sheer plane. In this revolution every point in the edge of the timber will move vertically—those above the knuckle upwards, and those below it downwards. Those points, therefore, which have been projected on the sheer plan from the sheer and level lines, will be found vertically over or under their projections, and at distances above or below the knuckle equal to the distances of their projections on the body from the intersection at the knuckle. On joining the points so formed we obtain the true shape of the moulding edge of the timber. Proceed in the same manner to obtain the projection of the bevelling edge on the sheer plan, remembering that in the revolution the plane of the bevelling edge must turn about the *same axis* as that of the moulding edge, so that the distances to be set above or below the knuckle to obtain the true shape must be measured, not from the point in which the projection in the body cuts the knuckle, but from a line, drawn from the point in which the moulding edge cuts the knuckle, and square to the projection of that edge. Sometimes there is an angle in the side of the timber at the knuckle, and the lower part of the timber is parallel to the sheer plan. The vertical projection of this portion of the timber would then, of course, be the true shape.

In the second case—*i.e.*, when the side of the timber is canted—the problem becomes more difficult. According to the only mode that has ever been adopted for laying them off, the positions of their heels cannot be determined beforehand, so that it is difficult to make a good arrangement of the timbers with regard to the short cant timbers below upon which they have to abut. Partly on this account, and partly also as a means of getting better conversion by using timber with a side curvature, the positions of the timbers of the stern are sometimes determined at the ship, and moulds are made there without the aid of the draftsman. This much, however, is certain, that the side of the timber can always be so canted as to bring the heel wherever it is required. Sometimes the cant necessary for this purpose may give too great bevelling to the timber. Should this ever be so, the timber must be cut with a side turn. In such a case the draftsman's art fails. But it is believed to be always possible to make a good arrangenent of the stern frame with straight-sided timbers. Let us proceed to show how this may be done. The method in use will be given afterwards.

New Mode of Laying-off Canted Timbers.—In the diagrams before us, the vertical plane of projection is taken a little on the fore-side of the knuckle; and the horizontal plane of projection is made to coincide with the plane of one of the level lines (No. II.), for a purpose which will be apparent as we go on. On these two planes, we have the projections of the knuckle and roughtree lines, and of the level lines I., II., III. Let ($a\,b$, $a'\,b'$), ($c\,d$, $c'\,d'$), and ($e\,f$, $e'\,f'$) be the upper portions of the moulding edges of three stern timbers. These portions of the projections of the timbers are obtained by fixing their positions on the knuckle, and drawing lines in both plans, leading to the projections of the apex of the cone. We must now proceed to find the projections below the knuckle, for which purpose it will be necessary to discover the traces on the two planes of projection of the plane of the moulding side of the timber. Take, for example, the middle one of the three timbers shown; then we must find a plane which contains the line ($c\,d$, $c'\,d'$). The horizontal traces of all the planes which satisfy this condition must contain or pass through the horizontal trace of the line, and their vertical traces must contain the vertical trace of the line. Produce $c\,d$ and $c'\,d'$—g' will then be the vertical projection of the horizontal *trace* of the line, and g, obtained from g', its horizontal projection. Similarly, i is the horizontal projection of the vertical *trace* of the line, and i', obtained from i, its vertical projection. The horizontal and vertical traces of the plane must therefore pass through g and i' respectively. There are evidently an infinite number of lines which could be drawn through these points, as there are an infinite number of planes which could be drawn through ($c\,d$, $c'\,d'$); and it is necessary to decide upon the direction in which the plane of the side of the timber shall lie. The horizontal trace may be drawn, if we choose, at right angles to the curve of the knuckle: in which case the horizontal section of the timber at the knuckle would be square; or it may be desirable to bring the heel of the timber upon the head of the cant timber, s, without regard to the bevellings. In that case mark a point, h, upon level line II., in such a position that a line passing through d and h may fall on the head of s; then if the line B be drawn through g and h, the horizontal projection of the edge of the timber will also pass through h, because level line II. is in the horizontal plane of projection. The line B, thus drawn, is the horizontal trace of the plane of the moulding side of the timber. The angles which it makes with the sheer and level lines indicate the bevellings which the timber will have in horizontal sections at those heights. If they are found too great, it must be concluded that the heel of the timber cannot be brought upon s. To obtain the vertical trace of this plane, observe first, that it must pass through i', and that it must meet the axis, $L\,T$, at the same distance from the middle line as B does, (*i.e.*) $L\,k'$ must be equal to $L\,k$. These two points are, however, too close together to define the line B' accurately; observe, therefore, that if a horizontal line, $C\,O$, were drawn from the point $c\,c'$, *in* the plane of which B is the trace, its horizontal projection would be $c\,o$, and its vertical projection $c'\,o'$. But the point O must be in the line of intersection of the plane of the side of the timber and the plane of projection, in other words, the vertical trace we seek must pass through O, or, which is the same thing since O is *in* the plane of projection, through o', its vertical projection. If, therefore, we join $k'\,o'$, we have the line B', the vertical trace required. It will be seen that the plane $B\,B$ cuts the planes I., II., III., in straight level lines starting from n', k', and p' respectively. That through k' is coincident with the trace B, and the others are parallel to it. The horizontal projections of these lines will evidently be $n\,r$, $k\,h$, and $p\,q$. The lowest of these lines, $p\,q$, lies in the same plane as the level line III., and since it also lies in the plane $B\,B'$, the point q in which it meets the level line, is in their intersection, and is therefore a point in the required edge of the timber. Similarly, h and r are points in this edge; d and c we already know to be so. Join d, r, h, and q by a curve, and we have the horizontal projection of the moulding edge of the timber. So also by means of the plane $A\,A'$, we obtain $b\,v$, the moulding edge of the outer timber, as we might also that of the inner timber by means of the plane $C\,C'$. To find points in the vertical plane corresponding to these, we have only to set off corresponding breadths on the several lines, by which we obtain as the vertical projection of the moulding edge c', d', r', h' q'. The points u and u', corresponding in like manner, give the ending of the edge at the side of the cant.

To discover the true shape, the plane containing the moulding edge must be thrown down upon the vertical plane of projection about the vertical trace—in this case therefore, about B'. During the revolution the points of which c', d', r', h', u', and q' are the projections, will describe circles at right angles to the line B', and will fall in lines drawn through these points at right angles to B'. Consider now for a moment the level plane III. Both P and Q, of which p' and q' are projections, lie in this plane, and their actual distance from each other is $p\,q$, seen in the half-breadth. In the revolution, P being in the axis, does not move; the point Q will therefore be found at a distance from the axis, or from p', equal to $p\,q$. Take then, in a pair of compasses, the length $p\,q$, and sweep a circle from p', cutting the square line through q' in Q, and Q will be a point in the moulding edge. Set off similarly $k'\,H$, equal to $k\,h$; $n'\,R$ (R is omitted in the figure) equal to $n\,r$; $m'\,D$ equal to $m\,d$; and $o'\,C$ equal to $o\,c$; join these points, and we have the true shape of the timber. In setting off the distances for the knuckle and roughtree, it must be observed that a line drawn from (d, d') in the plane of the moulding edge and parallel to the horizontal plane, will meet the vertical trace of the plane in m', below the curve. And that similarly a horizontal line drawn from $c\,c'$ in the plane of the moulding edge will meet the plane of projection in o'. It is therefore m' and o', and not points in the curved lines themselves, which correspond to m and o in the half-breadth, and from which the distances must be set off.

BREECH-LOADING SMALL ARMS.

Captain Norton writes:—"To the Editors of the Mechanics' Magazine. Gentlemen,—I am happy to be enabled to inform you that breech-loading sporting guns may be made available as military arms in case of emergency, simply by using gossamer cartridges, and a close-fitting spherical bullet enclosed in a thin greased patch of cotton net; this I successfully proved this day at Mr. Riley's shooting-gallery, 315 Oxford-street, W. The young man attending there fired three blank cartridges in succession without failure; the felt wad, forming the head of the cartridge, carries the unconsumed portion of the thin tough paper and cotton net clean out of the barrel at every discharge. The American civilians did good service with their smooth-bore sporting guns at the battle of Bunker's Hill. By following the above-described plan of using sporting guns, England could instantly command the willing services of a million ready-trained and well-armed guerillas of native growth, and racy of the soil. Your obedient servant, J. Norton. Rosherville, 23rd August."

It is expected that the Mersey, 40, screw frigate, at Spithead, will shortly receive several of Sir W. Armstrong's guns, in addition to her present armament.

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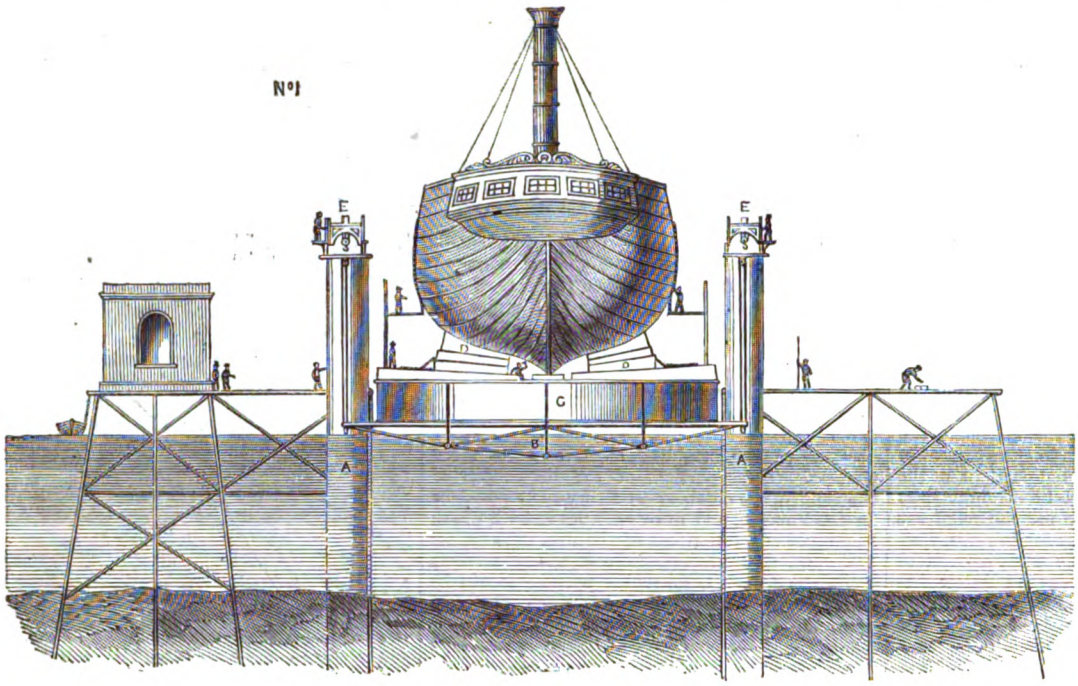
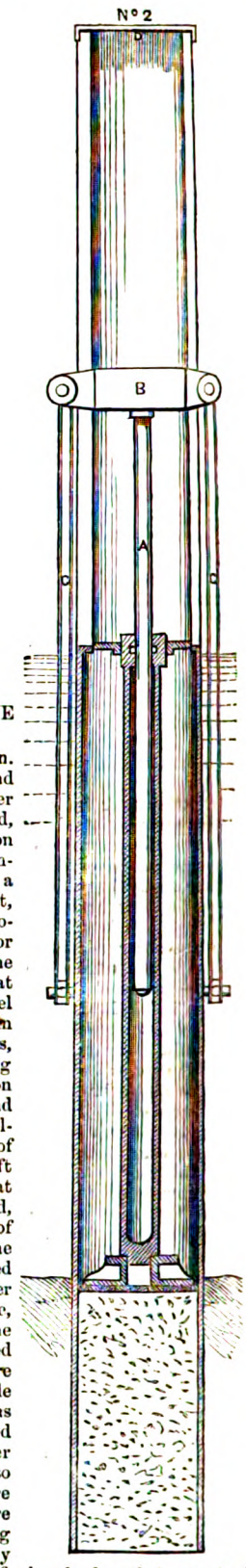
THE HYDRAULIC LIFT AT THE VICTORIA DOCKS.





THE HYDRAULIC LIFT AT THE VICTORIA DOCKS.

Invented by Mr. EDWIN CLARK.

ON Wednesday, the 27th of July, many who are interested in the progress of science had the pleasure of seeing in successful operation at the Victoria Docks Mr. Edwin Clark's method of ship-lifting, which appears likely to supersede the graving dock for many purposes. Mr. Clark's apparatus consists of a series of thirty-two upright hydraulic rams, of ten inches in diameter, placed in a waterway in two lines of sixteen each, far enough apart to admit of a ship of any burden passing between. Each ram is fitted with a cross-head of wrought-iron, and the crossheads are supplied with long straps, to the lower end of which are connected girders extending across from row to row. These girders, when the rams are down, are of course at the bottom of the water. The pontoon, on which the ship is raised, is formed of wrought-iron plate, strongly ribbed, the length and depth of which varies according to the size of the ship it is intended to lift. This pontoon is open at the top, and is of sufficient buoyancy, when empty, to support a vessel of very large tonnage. It is fitted with screw valves for admitting the water, so that in a very short time, when placed in position, it can be lowered down upon the cross girders. The rams are fed by a 50 lb. engine, which is fitted with twelve hydraulic pumps, 1⅞th in. diameter, and 2 ft. stroke, working at 18 strokes per minute, and the pipes from these pumps, before branching off to the rams, communicate with a series of valves arranged in a place built for that purpose close to the lift. By means of excentrics, which close the valves, any one of the rams can be disconnected at will from the supply, so that should one of the pipes burst, no danger can accrue to the ship, and the lifting process can be completed without delay.

At half-past 1 o'clock on Wednesday, the 27th, the pontoon being placed in position upon the girders, it was first filled and then lowered to the bottom of the water. After this the Jason, a ship of about 1,000 tons burden, was warped in, and having been fixed in position by means of ten sliding blocks, which were pulled into contact with the sides and bottom by means of chains brought above the water line, the engine was set to work, and the whole mass rose gradually out of the water at a speed of one foot in three minutes. As the pontoon came above the surface, it relieved itself of the water it contained, and the valves being then closed, the buoyancy of the saucer itself supported the ship in a perfectly steady and satisfactory manner. The whole operation, from the beginning to the end, extended over the space of 1½ hours, and the dead weight lifted, including the pontoon, was altogether above 1,600 tons. There are four pontoons constructed, and others in course of construction, which when raised in this manner, and floated, are to be towed with their burden into shallow bricked recesses provided for that purpose, so that the hydraulic power can be continuously applied for raising purposes. During an entertainment which followed the experiment, or rather the operation, Mr. Edwin Clark laid before his audience a clear and concise description of his invention, and the obstacles he had had to contend with in bringing it to its present state of perfection.

The engraving No. 1 shows a cross section of the lift, with a ship in the act of being raised. *A A* are two of the columns in which the rams are placed; *B* shows one of the cross girders; *C*, the end of the pontoon; *D D*, two of the sliding blocks for steadying the ship, and *E E* are two double purchase crabs for raising weights, and lifting the rams when required. These can be run about anywhere upon the top platforms, and are very useful adjuncts.

Engraving No. 2 is a section, in detail, of one of the columns, showing the ram, which is lettered *A*, the cross-head *B*, the side rods *C C*, and the cap plate *D*. It will be noticed that the hydraulic cylinder containing the ram rests upon a block of concrete, which fills up the inside of the column to the required height.

It will be needless for us to say much more upon the subject of Mr. Clark's invention. Its superiority over the old graving dock for many purposes is sufficiently manifest. Instead of a vast outlay upon excavations, masonry, and elaborate machinery in each instance, one hydraulic lift will do the work of any number of graving docks; and the only expense, beyond the first outlay, is providing an adequate number of pontoons for the work, and water space of any kind beyond three feet deep for floating them in.

A NEW MARINE LIGHT.

COMMODORE the Hon. James R. Drummond and the officers of Her Majesty's Dockyard, Woolwich, were on Saturday night last engaged in testing a newly-discovered light, denominated "the photophore," intended for lighthouses, and all the purposes of lights at sea. The paddle-wheel steam-vessel Bustler, in charge of Mr. Thomas, master - commanding the Fisgard, having on board Mr. Ferdinand Silas, a native of Holland (the inventor of the photophore), left the dockyard jetty at half-past 8 o'clock, and, having hoisted one of the new lights at the mast-head, proceeded slowly down the river for a short distance, while a number of the instruments passed along the banks were lighted up, the pale red glare of which was easily distinguished from that of all other lights, and was also pronounced to be more brilliant. Commodore Drummond remaining stationed on the jetty directed a course of signals by the constant lighting and extinguishing of the photophore, which was similarly replied to by the inventor on board the Bustler. One of the instruments attached to a line was thrown into the water without being previously lighted, and on rising to the surface it shot forth a phosphoric blaze, which, according to the inventor's statement, would keep alive for 10 or 12 hours.

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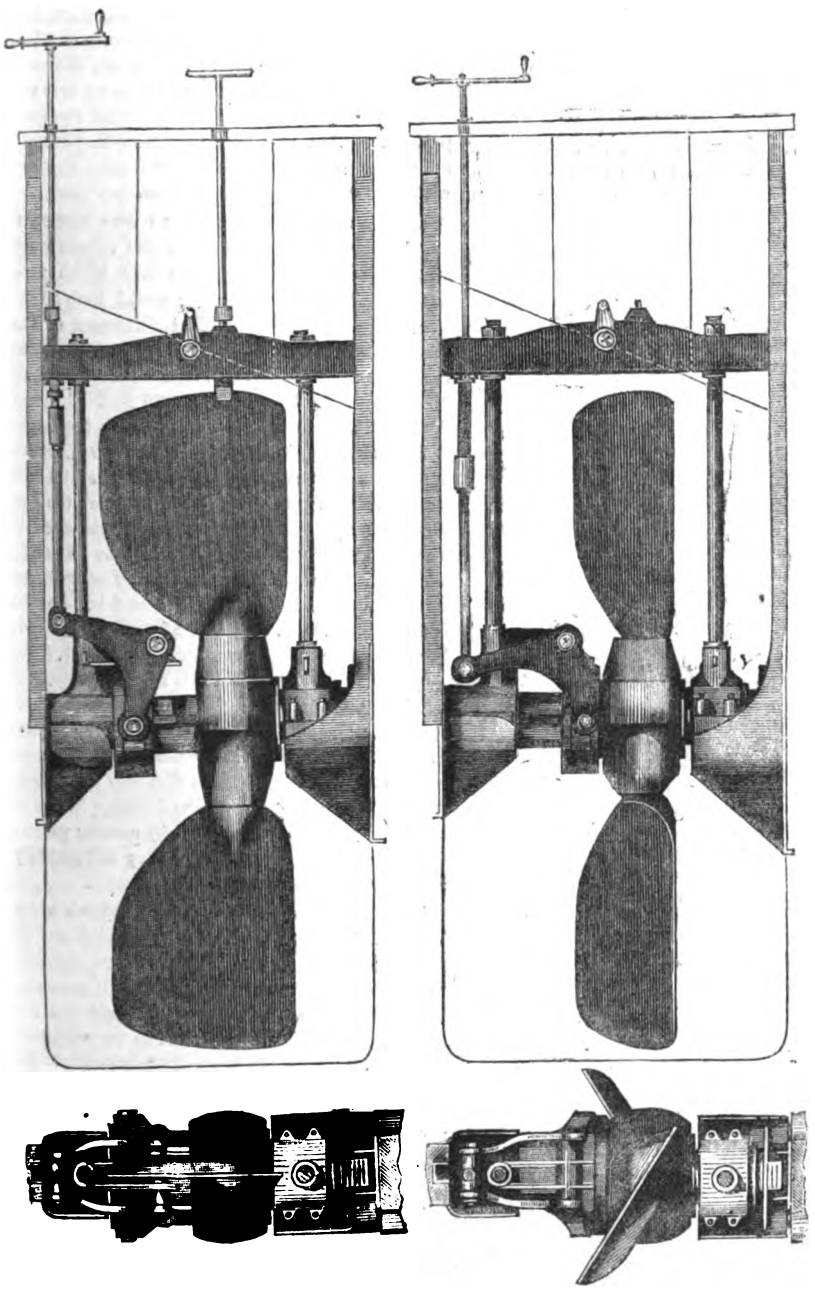
THE STEERING OF SCREW STEAM-SHIPS.

The difficulty of steering long ships has always been a great impediment to the lengthening of screw steam-ships, particularly in the case of war vessels, which should be capable of performing rapid evolutions. During some recent experiments on board his steam-yacht, the Dragon-fly, Mr. Joseph Maudslay discovered a fact which appears to us to have a very important bearing upon this subject. The screw-propeller of the Dragon-fly is fitted with feathering-blades, which are capable of having their pitch varied with the utmost ease from the deck, either when the screw is at rest or when it is revolving at any speed. The remarkable fact which Mr. Maudslay has observed is, that when both blades are set in the line of the keel—or, in other words, in the longitudinal plane passing through the centre of the ship—and the screw is set revolving, the vessel is turned round very rapidly. If, when the vessel is going at a considerable speed, in the usual way, the blades are rapidly brought into the position before stated, she also turns very quickly.

We content ourselves, for the present, with placing this fact on record, only remarking that, while it is not difficult to see how it is to be accounted for, it is impossible not to view it as very important.

We subjoin an engraving of Mr. Maudslay's feathering screw (which was published in our Magazine for 1856) in order that the nature of the feathering propeller may be apparent to our readers. A glance at the several figures will make its construction evident to practical men.



FREE DRINKING FOUNTAINS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—In an article on free drinking fountains in your excellent Magazine of the 19th instant, you describe certain arrangements which it is stated the Metropolitan Free Drinking Fountains Association has adopted for the filtration of water at their fountains. As this account is not altogether correct, we beg to be allowed to state that the only means hitherto used for the filtration of water at the fountains of the Association, as well as at various others in the metropolis, are the filters of the Moulded Carbon Company, designed and supplied by us. The annexed figure will probably afford a better explanation of the arrangement adopted, than that which is conveyed by your representation.

A is an iron cistern containing a hollow cylinder of moulded carbon *B*, which is suspended to the lid by a nut *F*, through which the pipe *E* is passed into the carbon. The unfiltered water enters by the pipe *C*, which is perforated on its underside within the cistern, and made to surround the cylinder; by this means the water flows continually over the whole surface of the carbon, and prevents the deposition of insoluble matter upon it, which is carried down to the bottom of the cistern, from where it may occasionally be drawn, and the whole cleaned out by opening the tap *G*. *D*, tap to regulate the supply. *E E* are union joints, by which the apparatus can be fixed

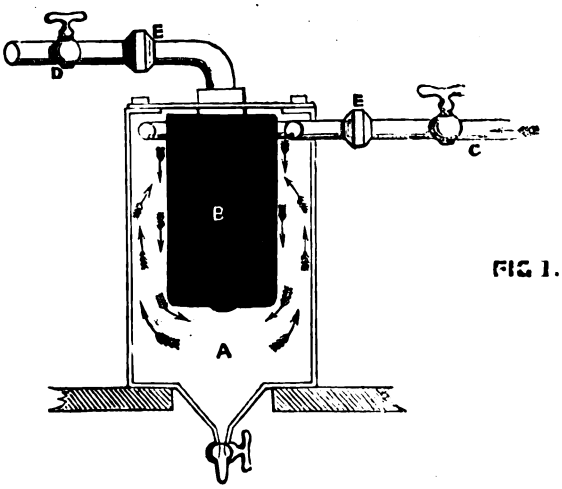


FIG 1.

or removed in a few minutes. This filter may also be conveniently attached to the main or supply pipe in dwellings.

As the names of others have been introduced in your article, by which it will be understood that the filtering medium has been prepared and supplied by them, we trust you will favour us by giving insertion to this letter in your next number. Harrison and Co.

62 Fleet Street.

ADMIRALTY EXPERIMENTS ON IRON-SIDED SHIPS.

A series of experimental trials have been carried on during the past fortnight at Portsmouth, with a view of ascertaining the amount of resistance offered by iron and steel plates of various manufactures when opposed to heavy ordnance at a short range. The trials are understood to have reference to the future coating of the steam ram now in progress of construction. The practice has been carried on from the Stork gunboat, tender to Her Majesty's ship Excellent, gunnery ship in Portsmouth harbour, both from a 32-pounder and a 95 cwt. gun, the latter throwing a solid 68lb. shot, with 16lb. charge of powder; the distance of range 200 yards. At this distance the results of the experiments have demonstrated in the clearest possible manner that no iron or steel

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plate that has yet been manufactured can withstand the solid shot from the 95 cwt. gun at a short range. The first shot would not penetrate through the iron plate, but it would fracture it, and on three or four striking the plate in the same place, or in the immediate neighbourhood, it would be smashed to pieces. As the results of the trial affected the steel plates it proved that a steel-clothed ship could be far more easily destroyed than a wooden-sided one, and that on the smashing-in of one of the steel-plates the destruction of life on the armed ship's decks, supposing the broken plate to be driven through the ship's side, would be something dreadful to contemplate, from the spread of the splintered material. At from 600 to 800 yards iron-clothed ships would be in comparative safety from the effects of an enemy's broadside, but it must be borne in mind that the effects of concentrated firing have yet to be ascertained on the sides of an iron-clothed ship, and account also must be taken of the damage the woodwork forming the inner sides of such a ship would receive from the driving-in of the broken plates; and which, as far as the present experiments have illustrated, would appear to prove that an iron or steel-clad ship, on receiving a concentrated broadside from a frigate, armed in a similar manner to the Mersey, and struck near her waterline, must sink then and there, with her armour on her back.—*Times.*

Literature.

The Navies of the World; their Present State and Future Capabilities. By HANS BUSK, M.A., of Trinity College, Cambridge. With Illustrations. London: Routledge, Warnes, and Routledge, Farringdon-street. 1859.

WHEN report on report and parliamentary return on parliamentary return, all abounding in information relating to the navy, came pouring forth at the commencement of the present year, we felt perfectly sure that some one or other would hash them up into the form of a volume, with a loud-sounding title, and have it advertised from one end of the world to the other. As Mr. Hans Busk, Master of Arts, Barrister-at-Law, Lieutenant of the Victoria Volunteer Rifles, author of "The Rifle, and How to Use It," &c., is rather fond of getting up books apparently, there seems to us no reason why he should not have been the man to undertake the business; and Mr. Busk himself appears to have thought the same. We are glad he has done so, because, he failing, the undertaking might have fallen into the hands of some idle person, who would have performed it far less satisfactorily than he. Considering who Mr. Busk is, and how very little he could be expected to know of the world's navies, he has really done his work astonishingly well. In order to acquaint our readers with the spirited manner in which he has gone about it, we quote the following extract from the author's preface. In perusing it, let no reader object to the frank testimony which Mr. Busk bears to the zeal and the successes of Mr. Busk. A little fluent freedom of that kind on the part of an author will not do us any harm—unless it should become common! Mr. Busk says:—

"An earnest desire to obtain authentic intelligence on these matters stimulated the author, during the latter part of the past year, to visit the several French naval stations, at some of which he encountered a variety of obstacles, although he finally succeeded in his object beyond his most sanguine expectations. In the prosecution of his inquiries, the writer travelled several thousand miles in France, associated and conversed with people of various grades and professions, as well at the military and naval stations, arsenals, and seaports, as in the large cities and manufacturing towns, and in the rural districts; with officers of both services, landed proprietors, merchants, lawyers, and also with peasants and artisans, sailors and fishermen. He had thus the best opportunities of acquiring information, and of learning the feelings entertained towards this country by a great number of Frenchmen. Although he cannot but admit that he experienced on no occasion any lack of personal courtesy, it must still be allowed that if some of the opinions he heard were reproduced at home, in the precise terms in which they were originally expressed, our national vanity would scarcely feel flattered by the sentiments towards us so frankly avowed. With the view, moreover, of fully ascertaining the real capabilities and present condition of the navy and arsenals of France, he passed some time at Toulon, at Rochefort, at Lorient, at Brest, and at Cherbourg, carefully investigating all that had been done of late years at those several ports, inspecting the works in progress at each. He was, besides, fortunate enough to obtain access to important and unpublished official documents, so as to check the accuracy of oral information. By this means he was enabled to ascertain precisely the present strength of the French marine, the age of every ship, the port at which she was built, the number of her guns, and in the case of steamers the horse-power of each. This information, collected as it is from trustworthy sources, cannot but be deemed, at the present juncture of considerable value; and if the jealous care of the French Government, in withholding such knowledge, be taken into account, and consequently the extreme difficulty of procuring statistical facts of the kind, in a country where not only no official navy list is published, but where no catalogue of the sort is allowed to be publically circulated under any pretence, some estimate may be formed of the toil necessary to succeed in an enterprise apparently so hopeless as the one undertaken by the author. Patient perseverence, however, overcame all difficulties, and the result of his labours will be found incorporated in the following pages. The summary there furnished will certainly afford matter for reflection. That very numerous class of our countrymen who have been accustomed, from the many disastrous defeats sustained at sea by France, during former wars, to regard her maritime resources as immeasurably inferior to our own, will learn with some astonishment that, chiefly owing to the energetic exercise of her indomitable will, she has been for some time past steadily gathering together her giant strength, and could at a very brief notice, if need were, equip for sea a fleet of more than four hundred vessels, of which nearly threescore would be ships of the line! At the same time, the whole available strength of England's bulwarks, numerically reckoned, cannot be considered very materially to exceed that of France, and this is especially the case as regards effective line of-battle ships and frigates. One of the author's chief objects, also, has been to collect authentic information on the present condition and future prospects of our own navy; in detailing which, in its proper place, he has ventured briefly to introduce such views and suggestions for its improvement as may have occurred to himself, or have been derived from a careful examination of the opinions expressed by experienced naval men and other competent authorities. A slight sketch of the actual state of the navies of other maritime powers — as Russia, the United States, Holland, Austria, Denmark, Sweden, &c.—has also been appended, so as to present, in a compact form, a comparative view of the existing 'navies of the world.' Besides the above topics, the author has thought it essential to a full elucidation of the subject to devote separate chapters to the consideration of other matters intimately connected with the whole question; such as the application of steam to ships-of-war, and especially the important introduction of the screw; naval gunnery, as based upon the vastly improved ordnance now in use, as well as the altered character of naval evolutions rendered necessary by these changes. He has, moreover, felt called upon to express his opinions upon the apparent inefficiency of the old Admiralty Board in coping with the urgent requirements of the present critical juncture. And, though last, not least in importance, our coast and land defences will be found discussed, if not with adequate ability, at least in a sincere and earnest spirit. In connexion with this latter topic, the author has ventured to call public attention to the great advantage of training a portion of the civilian population to the use of arms, through the medium of volunteer associations, organised under the sanction of Government, so as to be available on an emergency as a valuable reserve."

Although we are not disposed to treat Mr. Busk's volume with the gravity which a profound and well-studied work on the "Navies of the World" would deserve, we would have it understood that the author has not bestowed his labours grudgingly upon it. He has amassed an unexampled amount of information relative to the French navies and naval ports, and to this he has added useful descriptions of other foreign navies. His detailed lists of our own navy are also very copious and complete, and, so far as we have observed, very accurate also. The volume also comprises a reprint of the "Conversations-Lexicon" article on the English and French navies, together with a spirited review of the same.

But we cannot, in justice to our numerous naval readers, fail to say that the volume is not without serious errors—errors into which none but a purely amateur writer could have fallen. For example, in the detailed statement of the strength of our own navy, we are gravely informed, in a special note, that our three-deck screw ships draw from 35 to 36 feet of water! And, that there may be no doubt as to the deliberation with which these figures are given, we are further told that twenty-two of the two-deck screw ships draw about 34 feet; and the rest about 32 feet. Now, no naval man need be told that these are most absurd statements. The ship which draws more water than any other in our navy is the Duke of Wellington, and her draught is about 27 ft. 6 in. aft., and 25 ft. 6 in. forward; her mean draught being, therefore, 26 ft. 6 ins. —nearly 10 feet less than Mr. Busk says! After making all due allowances for Mr. Busk's circumstances, as the author of a work on a subject lying so very remote from his professional calling, we really are still astonished to find him falling into such an error as this. Ships drawing 36 feet of water may, perhaps, be built by coming generations, but if they should be, they will certainly find entrance into very few of our ports.

There are other portions of this volume which have but little interest for us, but which may be very useful nevertheless to many others, especially to those who are *not* readers of the MECHANICS MAGAZINE. We meet with a good deal that has appeared from time to time, and in various forms, in our columns; such as descriptions of the Armstrong gun, the Whitworth gun, Captain Norton's and Captain Blakely's inventions, Mr. Macintosh's system of warfare, and so forth. We also, we regret to say, meet with not a little loose writing about "Admiralty jobbery," the "shortcomings of that department," &c. We do not believe that such writing can do any good. We have already plenty of men who are fluent enough in quoting epithets; we want no more of them; what we *do* want are men who can take up facts

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with fairness and impartiality, weigh and balance them with intelligence, and then give us the result of their deliberations calmly, nothing extenuating nor setting down aught in malice.

On the whole Mr. Busk's book may be taken as a useful and timely compilation, and while no one must believe all that it says, many may read it with profit.

LIST OF NEW BOOKS.

Archer's Universal Yacht Signals, 3rd edition, 10s.
Catechism of Photography, 1s.
Eaton's Examples in Arithmetic and Mensuration, 1s.
Eley's Geology in the Garden, 6s.
Galbraith and Haughton's Arithmetic, Key to, 5s.
Galbraith and Haughton's Mechanics, Key to, by M'Dowell 5s.
Galbraith and Haughton's Plane Trigonometry, Key to, 5s.
Griffith's Artillerist's Manual, 8th edition, 7s. 6d.
Hartley's Handy Book for Rifle Volunteers, 7s.
How to Colour a Photograph, 1s.
Maury's Physical Geography of the Sea, new edition, 5s.
Quested's Act of Land Surveying, 5th edition, 3s. 6d.
Smith's National Defence in Practice, 1s.
Stevenson's Civil Engineering of North America, 2nd edit., 3s. (Weale.)
Thomas's Practical Treatise on Rifled Ordnance, 12s. 6d.
Thomson's System of Interest Tables, new edition, 3s. 6d.
White's Catechism of the Marine Steam-Engine, 2s.

THE STRENGTH OF GLASS GLOBES AND CYLINDERS.

By W. Fairbairn and T. Tate.

The following communication was read to the Royal Society:—"On the resistance of glass globes and cylinders to collapse from external pressure, and on the tensile and compressive strength of various kinds of glass." By William Fairbairn, Esq., C.E., F.R.S., and T. Tate, Esq., F.R.A.S. Received May 3, 1859. We have since obtained the following official abstract of the paper:—

The researches contained in this paper are in continuance of those upon the resistance of wrought-iron tubes to collapse, which have been published in the "Philosophical Transactions" for 1858. The results arrived at in those experiments were so important as to suggest further inquiry under the same conditions of rupture with other materials; and glass was selected, not only as differing widely in its physical properties from wrought-iron, and hence well fitted to extend our knowledge of the laws of collapse, but because our acquaintance with its strength in the various forms in which it is employed in the arts and in scientific research is very limited. To arrive at satisfactory conclusions, the experiments on this material were extended so as to embrace the direct tenacity, the resistance to compression, and the resistance to bursting, as well as the resistance to collapse.

The glass experimented upon was of three kinds.—

	Specific gravity.
Best flint-glass	3·0782
Common green glass	2·5284
Extra white crown-glass	2·4501

TENACITY OF GLASS.

For reasons detailed by the authors, the experiments upon the direct tenacity of glass made by tearing specimens asunder are less satisfactory than those in the rest of the paper; and it is argued that more reliance is to be placed upon the tenacity deduced from the experiments on the resistance of globes to bursting in which water-pressure was employed, than upon the tenacity obtained directly by tearing specimens asunder. The results obtained by the latter method give the following mean results:—

	Tenacity per square inch in pounds.
Flint-glass	2413
Green glass	2896
Crown-glass	2346

RESISTANCE OF GLASS TO CRUSHING.

The experiments in this section were made upon small cylinders and cubes of glass crushed between parallel steel surfaces by means of a lever. The cylinders were cut of the required length from rods drawn to the required diameter, when molten, and then annealed, in this way retaining the exterior and first cooled skin of glass. The cubes were cut from much larger portions, and were in consequence probably in a less perfect condition as regards annealing. Hence, as might have been anticipated the results upon the two classes of specimens, although consistent in each case, differ widely from one another.

The mean compressive resistance of the cylinders, varying in height from 1 to 2 inches, and about 0·75 inch in diameter, is giving on the following table:—

Description of glass.	Height of cylinder in inches.	Mean crushing weight per sq. in. in lbs.	Mean crushing weight per sq. in. in tons.	Mean crushing weight per sq. in. in lbs.	Mean crushing weight per sq. in. in tons.
Flint-glass	1	29,168	13·021	27,582	12·313
	1·5	20,775	9·274		
	2·0	32,803	14·644		
Green glass	1	22,583	10·081	31,876	14·227
	1·5	35,029	15·628		
	2·0	38,105	16·971		
Crown-glass	1·0	23,181	10·348	31,003	13·840
	1·5	38,825	17·332		

The specimens were crushed almost to powder by the violence of the concussion; it appeared, however, that the fracture occurred in vertical planes, splitting up the specimen in all directions. Cracks were noticed to form some time before the specimen finally gave way; then these rapidly increased in number, splitting the glass into innumerable prisms, which finally bent or broke, and the specimen was destroyed.

The following table gives the results of the experiments upon the cut cubes of glass:—

	Mean resistance to crushing. in pounds.	in tons.
Flint-glass	13,130	6·861
Green glass	20,206	9·010
Crown-glass	21,867	9·762

Hence, comparing the results on cylinders with those on cubes, we find a mean superiority in the former case in the ratio of 1·6 : 1, due to the more perfect annealing of the glass.

ON THE RESISTANCE OF GLASS GLOBES TO INTERNAL PRESSURE.

In these experiments the tenacity of glass is obtained by a method free from the objections to that before detailed. Glass globes, easily obtained of the requisite sizes, in a nearly sperical form, were subjected to an internal pressure obtained by means of a hydraulic pump, uniformly and steadily increased till the globe gave way. The lines of fracture radiated in every direction from the weakest part, passing round the globe as meridians of longitude and splitting it up into thin bands, varying from $\frac{1}{30}$th to $\frac{1}{4}$th of an inch in breadth.

The following table gives the results of the experiments on the resistance of glass globes to internal pressure:—

Description of glass.	Diameters.	Thickness.	Bursting pressure per sq. in.
	Inches.	Inches.	Pounds.
Flint-glass	4·0 by 3·98	0·024	84
	4·0 by 3·98	0·025	93
	4·0	0·038	150
	4·5 by 4·55	0·056	280
	5·1 by 5·12	0·058	184
	6·0	0·059	152
Green glass	4·05 by 5·0	0·022	90
	4·05 by 5·0	0·020	85
	4·0 by 4·05	0·018	84
	4·0 by 4·03	0·016	82
Crown-glass	4·2 by 4·35	0·025	120
	4·05 by 4·2	0·021	126
	5·9 by 5·8	0·016	69
	6·0 by 6·3	0·020	86

The formula which expresses the relation of the bursting pressure to the thickness and diameter of the globe, is:—

$$P = \frac{aT}{A};$$

where a = the longitudinal sectional area of the material in square inches, that is, in the line of rupture or line of minimum strength; A = the longitudinal sectional area of the globe in square inches; and T = the tenacity of the glass in pounds per square inch. Hence, from the above experiments we deduce:—

Pounds.
T = 4200 for flint-glass,
= 4800 for green glass,
= 6000 for crown-glass,

5000 = mean tenacity of glass.

Here the mean tenacity is nearly twice that obtained in the experiments upon thick bars; a result which, perhaps, corresponds with the difference between the crushing strength of cylinders and cubes, and is largely attributable to the condition of annealing.

ON THE RESISTANCE OF GLASS GLOBES AND CYLINDERS TO AN EXTERNAL PRESSURE.

The manner of conducting these experiments did not differ in any essential detail from that pursued in the experiments upon wrought iron. The globes and cylinders, after having been hermetically sealed in the blowpipe flame, were fixed in a wrought-iron boiler communicating with a hydraulic pump. In this position an increasing pressure was applied until the globes broke, the amount of pressure at the time being noted by means of a Schäffer pressure-gauge. During the collapse the globes were reduced to the smallest fragments, so that no indication of the direction of the primary lines of fracture could be discovered.

The following table contains a summary of the results on globes subjected to an external pressure:—

Description of glass.	Diameters.	Thickness.	Collapsing pressure per sq. in.
	Inches.	Inches.	Pounds.
Flint-glass	5·05 by 4·76	0·014	292
	5·08 by 4·7	0·018	410
	4·95 by 4·72	0·022	470
	5·6	0·020	472
	8·22 by 7·45	0·010	35
	8·2 by 7·2	0·012	42
	8·2 by 7·4	0·015	60
	4·0 by 3·98	0·024	(900*)
	4·0	0·025	(900*)
	6·0	0·059	(1000*)
Green Glass	5·0 by 5·02	0·0125	212

The following table contains a similar summary of the results upon cylindrical vessels:—

Description of glass.	Diam.	Length.	Thickness.	Collapsing pressure per sq. in.
	Inches.	Inches.	Inches.	Pounds.
Flint-glass	3·09	14·0	0·024	85
	3·08	14·0	0·032	103
	3·25	14·0	0·042	175
	4·05	7·0	0·034	202
	4·05	7·0	0·046	380
	4·06	13·8	0·013	180
	4·02	13·8	0·064	297
	3·98	14·0	0·076	382
	4·05	7·0	0·079	(500†)

The paper includes an investigation of the laws of collapse in these results, and the following general formulæ are obtained:—

For glass globes ..... $P = 28,300,000 \times \frac{k^{2\cdot4}}{D^{2\cdot4}}$,

For glass cylinders... $P = 710,000 \times \frac{k^{3\cdot4}}{D.L}$,

where P = the collapsing pressure in pounds per square inch; k = thickness in inches; D and L = diameter and length respectively in inches.

These are the general formulæ for glass vessels subjected to an external pressure, and the latter is precisely similar to that found for sheet-iron cylinders.

TRANVERSE STRENGTH OF GLASS.

The authors derive the general formula

$$W = 3140 \times \frac{K.D}{l},$$

where W = breaking weight in pounds, K = area of

* These globes remained unbroken.
† Remained unbroken.

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transverse section, D = depth of section, l = length between supports; to express the transverse strength of a rectangular bar of glass supported at the ends and loaded in the middle.

Our Weekly Gossip.

Charles Barry sends us the following letter, in ence to that of Mr. Loseby which appeared a fortnight since in this Magazine, and in the Society of Arts' *Journal* the succeeding week:—

"TO THE EDITORS OF THE MECHANICS' MAGAZINE."

"Gentlemen,—My attention has been called to a letter in the last number of the *Journal of the Society of Arts*, from Mr. Loseby, respecting the Westminster clock, in which he alludes to a statement recently made in the House of Commons by Mr. Fitzroy respecting the minute hands made by my authority, the weight of each of which he reported to be above 3 cwt.

"That statement was made, I find, upon the authority of Mr. Denison alone, and, as it has already misled Mr. Loseby, and possibly the public also, I think it right to put you in possession of the facts of the case.

"These hands, which are now condemned by Mr. Denison, were prepared under his own control; one of them was submitted to him as a specimen before the remaining three were made, and met with his cordial approval; the others were made by his orders, in strict accordance with the specimen which he had approved; and he fixed the whole of them when finished, and made himself responsible for the cost of so doing. The weight of each hand, exclusive of the external counterpoise, is 1 cwt. and 25lbs.

"It is obvious, therefore, that Mr. Denison, and he alone, is as fully responsible for those hands as he is for all the other going parts of the clock.

"I am, Sir, yours faithfully,

"CHARLES BARRY."

"Old Palace-yard, Aug. 23."

A correspondent—an experienced naval officer—politely favours us with the following remarks upon the Russian frigate General Admiral, now lying at Spithead:—"I have just come on shore from a visit to the Russian frigate General Admiral, and I will give you some rough notes of my observations. She is certainly a very fine vessel, built quite on the American plan, with fine lines forward and aft, much spring, no head knee, and altogether resembling a large cotton ship with guns in her. We were certainly much disappointed with her main deck: the guns are very close together, ports only seven feet from each other, and the beam of the ship not in proportion to her length. The ship had been so recently commissioned that it could not be expected that she should be in perfect order; but still she was very fair, and every endeavour was evidently being made to fit her well up. The guns were being polished, and the crew were otherwise actively engaged in bringing her into order. She has guns on her gangways, and the objection which has hitherto existed towards this by the want of room has been met by stowing the boom on gallows, leaving the whole deck clear. A very large bridge nearly covers the quarter deck, under which is a cabin, which we understood was the captain's. The armament consists of thirty 7½ inch. guns and two 5 inch guns on main deck, and twenty-eight 8 inch and two 10-inch on upper deck, making in all *sixty-two* guns mounted, although she is pierced for seventy-two guns. The carriages of the broadside guns are on the French plan—no after trucks—each carriage being provided with a roller handspike for training, &c. The knees of the ship are wood, with a thin broad iron plate on the outside. Large bins extend the whole length of the lower deck for the men's clothes. We understood that she has not all her coals on board; the midship main deck port is 12 ft. 2 in. out of the water, which, of course, is a great height. One of the officers informed us that she was 325 feet between perpendiculars. The main deck is 7 ft. 6 in. high between the beams; the engines were stated to be 800-horse, and the greatest speed they have got out of her 12½. Just after we had left, the Mersey ranged up close alongside; and the comparative sizes, &c., of the two frigates were admirably seen. The impression left on our minds was that the Mersey was much the finest frigate of the two. Yet I must repeat that His Imperial Majesty's ship General Admiral is unquestionably a fine frigate, and suggests the necessity of our keeping a vigorous eye upon a country which is evidently endeavouring to excel in this important description of ship-of-war." In a former number of the MECHANICS' MAGAZINE the following memoranda respecting this vessel (which was built at the yard of Mr. Webb, of New York), was copied from the *Scientific American*:—"Her model is what is called the long flat floor, full bilge, sharp end, round stern, no poop or cut-water, and short forecastle deck. She is expected to attain a speed of fourteen knots under sail, and her draft of water will not exceed 25 feet. Her dimensions are:—Length on spar deck, 307 feet; breadth, 55 feet; length over all, about 325 feet; depth to spar deck, 34 feet. She is pierced with 44 side ports and two stern ports on the lower deck, and 30 side ports and 4 large ports forward, and 4 large ports on the spar deck. Her armament will consist of 40 shell guns of large calibre on the gun deck, and 20 long guns and 2 pivot guns of largest size on her spar deck. She is built of white oak, and will be propelled by two direct horizontal engines, now building at the Novelty Works, this city, each cylinder of which will be 84 inches in diameter, and 3 feet 9 inches stroke, with a nominal power of 2,000. The propeller is 19½ feet in diameter, and is one of Griffith's patent."

"Sir William Armstrong, Superintendent of the Rifled Ordnance Department at Woolwich, has succeeded," we are told by the *Times*' correspondent, "in accomplishing the method of rifling the whole or any requisite number of the guns employed in the service which present a surface at the bore fit to receive and maintain the grooves, and which possess a body of sufficient tensile strength to resist the explosive power required to expel, with safety, the heavy shot now in use. Some experiments have been carried out at Shoeburyness in the most successful manner with some of the guns which have undergone the metamorphosis, or transformation from the smooth to the rifled bore, hitherto considered impracticable. The first gun submitted to trial was an 80-pounder on Sir William's original plan: the second, an ordinary 32-pounder service gun rifled on a plan of Sir William Armstrong's, adapted for elongated cast-iron shot or shell. They were transported from the department in Woolwich Arsenal without preliminary proof or test, as the most implicit confidence is placed in the judgment of Sir William Armstrong, and were fired over a range of 3,400 yards. The result exceeded the general anticipation. The target was six feet square, into which every shot—namely, six rounds from each gun—penetrated with terrific and certain aim (*sic.*). The energy and diligence displayed in the present restricted limits of the establishment present ample evidence of Sir W. Armstrong's stipulation to furnish 100 guns for service during the present year being fully and faithfully performed. The whole of that number are already in form, and will be completed and delivered under ordinary circumstances long before the prescribed period." We quote this not very lucid statement that it may be taken for what it is worth; but we warn our readers against attaching too great importance to it. If the writer is not careful he will be making us believe that a common gun rifled is of more value than the costly and delicate, though famous, Armstrong gun.

"Sidmouth, August 21, 1859.—Gentlemen,—I feel much indebted to Mr. Hearder for the very kind manner in which he replied to my question with respect to the magnetic coil and battery, which appeared to me very much to the purpose,—that by adding another pair of plates to the battery and connecting similar poles you simply double the surface. I have tried the experiment in the manner Mr. Hearder proposed, viz., dividing my battery of twelve into two of six, and connect their similar poles: they give about the same result as before, that is, with the eleven in series and one extra. I find when operating with the two sixes if I take an extra pair of plates and connect similar poles the effect is again doubled or trebled, and I think it cannot be attributed to extra surface, as proposed by Mr. Hearder, inasmuch as if I only dip the tip of the plates in, it has all the effect the same as immersing the whole. I believe a thimble battery would be quite sufficient for the extra pair. If Mr. Hearder would try the experiment and give the result through the MECHANICS' MAGAZINE, he will confer a great favour on yours very truly, S. CHICK."

On Tuesday and Wednesday the Great Eastern was densely crowded with visitors, the grand saloon, which had been closed in consequence of damage done to the furniture by some ill-disposed persons, being re-opened for inspection on those days only, and the price of admission being raised to 5s. It is stated that no public intimation will be given as to the exact time of her departure from the Thames, in order to avoid the inconvenience which might arise from a crowded state of the river.

NOTICES.

M., of Preston.—Do not be angry with us: answering questions is really no part of our business, and if it were it would be a part to which we could not afford to devote time. Nine out of ten of the requests made to us in this respect are either absurd or inconsiderate, and we therefore attach but little importance to them. You, being a sensible man and a man of business, we hope, would, we dare say, become as guilty as ourselves were you in our position. The screw propeller to which you refer is Mr. Joseph Maudslay's patent feathering screw, and the yacht in question is the Dragon Fly. The screw was described and illustrated in the MECHANICS' MAGAZINE, No. 1724, for Aug. 23, 1856; it has not, we think, been altered from the form there described. (See p. 137.) We cannot undertake to prescribe for the pitch of your new screw.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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THE demand for Mr. E. J. REED'S paper—

ON THE MODIFICATIONS WHICH THE SHIPS OF THE ROYAL NAVY HAVE UNDERGONE DURING THE PRESENT CENTURY, IN RESPECT OF DIMENSIONS, FORM, MEANS OF PROPULSION, AND POWER OF ATTACK AND DEFENCE,"

has been so great that the Journal of the Society of Arts, the MECHANICS' MAGAZINE, and all other Scientific Journals in which it appeared in December last, are now out of print. The demand still continuing, it has been deemed desirable to reprint it in a separate form. An 8vo. edition of it, in large type, and on fine paper, has, therefore, been prepared, and may now be had at the Office of this Magazine, price 1s.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 65, 70, 90, 97, 98, 108, 120.

BOILERS AND THEIR FURNACES, &c., 69, 86, 89.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 81, 112.

SHIPS AND BOATS, including their fittings, 66, 92, 107.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 110.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals. *None.*

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 49, 52, 53, 54, 59, 78, 88, 105, 118.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 99.

LIGHTING, HEATING, AND VENTILATING, 55, 77.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 57, 69, 74, 76, 83, 90, 93, 109, 111, 116, 117.

METALS, including apparatus for their manufacture, 101, 101.

CHEMISTRY AND PHOTOGRAPHY, 51, 67.

ELECTRICAL APPARATUS, 56, 94, 87, 96, 119.

WARFARE, 114.

LETTER PRESS PRINTING &c. *None.*

MISCELLANEOUS, 50, 58, 61, 62, 63, 64, 68, 71, 72, 73, 75, 79, 80, 82, 85, 87, 94, 95, 102, 103, 104, 106, 113, 115.

49. J. H. JOHNSON. "An improved textile fabric, applicable to the manufacture of varnished cloths, and to other purposes." (A communication.) Dated Jan. 6, 1859.

This fabric presents two different appearances in its face and back; the one surface is composed of a fine warp and weft, and the other of a considerably coarser warp and weft: and the two surfaces are connected together by occasional threads of the finer warp being interwoven with the coarser warp and weft. *Patent abandoned.*

50. J. H. JOHNSON. "Improvements in machinery or apparatus for boring or piercing rocks, applicable also to the dressing or working of stone, and as a power hammer generally." (A communication.) Dated Jan. 6 1859.

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This machine is composed of two principal and distinct parts, the first portion, and the moveable portion. The power consists, 1, of a steam-engine driving a shaft in the ordinary manner; 2, of two parallel beams upon which the moving parts slide, and which are formed with portions of screw threads or racks on their inner faces; 3, of a square sectioned second motion driving shaft for transmitting all the requisite movements. The details are voluminous. *Patent completed.*

51. W. Spence. "Improvements in the mode of taking photographic pictures on wood." (A communication.) Dated Jan. 7, 1859.

This consists in the application of the albumen so as to form an insoluble base within the pores of the wood, and the taking of the photographic pictures on wood, the pores of which have been filled with gelatinous matter, and subsequently removing the gelatine from the block without injury to the picture, by the application of a warm solvent. *Patent completed.*

52. I. and A. Holden. "Improvements in means or apparatus employed in preparing and combing wool and other fibres." Dated Jan. 7, 1859.

This comprises various improvements in preparing wool and other fibres, and relates more especially to that method of combing where the fibre is passed through two sets of gill combs. *Patent completed.*

53. E. Heywood. "Improvements in weaving." Dated Jan. 7, 1859.

This consists in the production of double fabrics united in the weaving at parts, and enclosing between them thread or yarn as stuffing, such fabric being adapted for various purposes. *Patent completed.*

54. J. J. Florence. "Improvements in reels or spooling-wheels." Dated Jan. 7, 1859.

This invention is not described apart from the drawings. *Patent completed.*

55. G. K. Gevelin. "Regulating gas-burners, which he calls the 'Universal Gas Burner Regulator.'" Dated Jan. 7, 1859.

The difference between the ordinary gas regulators with valves and this consists in that the inventor interposes between the valve and the burner an inner perforated chamber, the whole of which will not pass more gas under low pressure than is necessary for the consumption of the various kinds of burners. *Patent completed.*

56. A. Barclay. "Improvements in electric and magnetic telegraphs." Dated Jan. 7, 1859.

This invention relates to some extent to two inventions of improvements in electric magnetic telegraph wires or conductors, also improvements in obtaining and distributing or applying electricity and magnetism and in obtaining motive power therefrom, for which the present inventor obtained provisional protection, and it consists of certain arrangements whereby electric and magnetic telegraphs may be rendered of superior efficiency in working. *Patent abandoned.*

57. J. Paterson. "An improvement in bands and belts for the waist." Dated Jan. 7, 1859.

This consists in rendering leather belts and bands of the waist elastic by introducing one or more pieces of elastic web under one or more covering pieces of leather, and connecting the elastic web to the ends of the leather forming the belt. *Patent abandoned.*

58. H. Reynolds. "Improvements in refining and decolorizing saccharine substances." Dated Jan. 7, 1859.

For bleaching and decolourizing saccharine substances the inventor uses stannate of alumina, the stannate and meta stannate of lime, as well as the free meta stannate, and stannic acids, and several other chemical compounds of tin. *Patent abandoned.*

59. W. E. Newton. "Improvements in machinery for winding, twisting, and doubling fibrous materials." (A communication.) Dated Jan. 7, 1859.

This invention cannot be described without reference to the drawings. *Patent completed.*

60. H. Harden. "Improvements in fire-bars for steam-boiler and other furnaces." Dated Jan. 8, 1859.

This consists in forming and arranging fire or grate bars so that the space between them for the admission of air will pass in a zig-zag line, thus breaking up the grate surface into a series of short parallelograms, and each of which is nearly surrounded by an air space, so that there are no considerable lengths that are unbroken by air spaces as in ordinary bars. *Patent completed.*

61. C. F. Vasserot. "An improved chain and bucket pump." (A communication.) Dated Jan. 8, 1859.

This invention consists of an iron endless chain formed of long links having double articulation. Each joint is rivetted by means of a steel bolt. Each link passes through the centre of a bucket to which it is fixed, the capacity of the buckets being in proportion to the power to be employed for working the apparatus. *Patent abandoned.*

62. D. Friedlauder. "An improved smoking-pipe." Dated Jan. 8, 1859.

This consists in connecting the bowl of the pipe with its stem or tube, by inserting each into the sides of an india-rubber ball. *Patent abandoned.*

63. T. B. Hubbell. "An improved trap for rabbits, rats, mice, and other like animals and vermin." (A communication.) Dated Jan. 8, 1859.

This trap is composed of a ring or frame, having connected with it a barb or spear, or barbs or spears attached to a cross piece, and acted upon by a spiral or other spring, so that when the trap is set the barbs or spears fly across the same, and penetrate and hold the animal. The trap is set by a jointed rod or lever which keeps it set while the parts of the rod or lever are kept in a line, but lets it off under the action of the spring as soon as the parts are put out of line by the animal touching one of them. *Patent abandoned.*

64. F. Versmann and A. Oppenheim. "Improvements in the treatment of various substances by which to render the same uninflammable." Dated January 8, 1859.

This relates to the adaptation of salt of tin, antimony, and zinc, excepting the chloride of zinc, to the articles to be rendered uninflammable. *Patent abandoned.*

65. A. W. Williamson. "Improvements in condensers for steam-engines and other purposes." Dated Jan. 8, 1859.

These improved condensers consist of a metal case to which a number of tubes are connected at one end. These tubes are closed at their other ends, and contain each of them a smaller tube passing from the closed end of the exterior tubes to a smaller case contained within the case before mentioned. *Patent abandoned.*

66. W. Delany. "Improvements in submarine boats or vessels, and in apparatus used for working under water." (A communication.) Dated Jan. 8, 1859.

Here a vessel is constructed of an egg-shaped form in transverse section, and running off to a point at both ends, and fitted with one or more keels to keep the vessel steady in the water. The sinking and floating of the vessel are affected by means of tanks for the reception of air or water. The vessel is fitted with a screw propeller for shifting her position. In conjunction with this vessel a diving armour is employed so that a diver may leave the vessel to do whatever may be required. *Patent abandoned.*

67. W. Clark. "Improvements in purifying natural phosphates of lime." (A communication.) Dated Jan. 8, 1859.

This invention consists of various processes for the purification of natural phosphates of lime to render them more soluble and easier of transportation, which processes are severally applicable according to the variable composition of the phosphates of lime. *Patent abandoned.*

68. E. Cobbold. "Improvements in instruments for writing and marking, and for the preparation of certain substances for conversion into instruments for writing and marking, and for the application to useful purposes of certain products arising from preparation aforesaid." Dated Jan. 8, 1859.

In order to render reed or cane, or other similar stalks, suitable for conversion into an instrument for writing, the inventor divests the same, or strips thereof, by means of a sharp gauge-like instrument, of all, or of a sufficient portion, of the internal soft, cellular, spongy material, to render such reed or strips, or portions of reed or cane, when made into pens, either by means of a penknife or other suitable instrument, capable of performing clear and fine writing equal in every respect to the writing produced by the quill and metal pens of commerce. *Patent completed.*

69. J. T. Forster. "Improvements in bed births applicable for bunks, hammocks, cots, and other fixed and moveable sleeping places." Dated Jan. 8, 1859.

These improvements in bed berths consist in the application of canvas or sacking bottoms, which the inventor nails or otherwise fixes at each end, or at the sides, to forms or pieces of wood or other material, shaped and of an extent suitable to keep the canvas distended and in the form required. When used for bed places or bunks on board ship he lashes or otherwise fixes them up at each end to stanchions or other fixtures by which they are stretched. *Patent completed.*

70. W. E. Newton. "Improvements in steam-engines and steam generators." (A communication.) Dated Jan. 8, 1859.

This comprises various improvements in marine and stationary engines, and also in boilers by which greater power is obtained from the elastic force of the steam than in engines of the ordinary construction, and economy of fuel is effected. The details are voluminous. *Patent completed.*

71. W. A. Lyttle. "Taking the place of springs in many, if not all, of the combinations into which they enter, and also for equilibrating a varying force or weight." Dated Jan. 8, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

72. R. D. Clegg. "Improvements in signalling apparatus." Dated Jan. 10, 1859.

This invention is not described apart from the drawings. *Patent completed.*

73. L. A. Normandy, jun. "Improvements in the process of distilling and clarifying resinous substances." (A communication.) Dated Jan. 10, 1859.

This comprises, 1, an agitator which being placed in the still, prevents the burning of the substance, and by rakes continually stirring up the bottom, the incrustation of the substance is prevented. The agitator at the end of each heating drives away also all foreign bodies. 2. Of a reservoir into which the resin is led as it leaves the still, and by reason of the different specific gravities of the substances the earthy matters are in a short time deposited therein. 3. Of rotary filters provided with fine metallic cloths or wire gauze, by which all the foreign substances held in suspension in the resin are retained. After these operations the products will be found perfectly purified. *Patent abandoned.*

74. T. J. Claxton. "Improvements in the manufacture of boots and shoes." (A communication.) Dated Jan. 10, 1859.

This consists in applying to the toes of boots and shoes a guard or cap of metal, gutta-percha, or india-rubber, *Patent completed.*

75. F. Lehr. "Improvements in machinery for manufacturing metallic ribs for umbrellas, parasols, and other articles." Dated Jan. 10, 1859.

This comprises, 1, a reciprocating jaw or pincer, for feeding and drawing the wire. 2. A shear having a compound motion to cut off the wire. 3. Clumps for holding the wire. 4. Mandrils and turning slubs to bend or coil up the wire to form loops or eyes as required. 5. A mandril and turning slub which takes the end of the wire and turns thereon a loop or eye for the joint by which the end of the rib is attached. *Patent completed.*

76. J. S. Margetson. "An improved box or case, suitable for hats, collars, and other useful purposes." Dated Jan. 10, 1859.

Here a piece of card board or other suitable material is cut into a strip and bent into a cylindrical form, after which it is placed into a bag or reticule made in a like form, having a bottom inserted. The upper part of this bag projects above the top edge of the card board, &c., and has eyelet holes through which cords are passed. Upon drawing these cords in opposite directions the mouth of the box is closed. *Patent abandoned.*

77. J. White. "Improvements in cleansing or purifying air, and in increasing or reducing the temperature thereof, and in the application of air so treated to sanatory and other uses." Dated Jan. 10, 1859

Here the air is caused to pass through channels, into which, and in contact with such air, water is caused to flow in jets or streams; or the air is forced into water in suitable vessels. By impregnating the water thus used with suitable purifying agents adapted to absorb or neutralize impurities combined with the air, putrifaction thereof will be effected, whilst by heating or cooling the fluid thus used, the temperature of the air may be increased or reduced to the extent desired. *Patent completed.*

78. T. H. Toms. "The employment of certain materials for the production of raised ornamental figures or devices upon textile fabrics." Dated Jan. 10, 1859.

This consists in employing braid, manufactured from mohair coiled round a central core or cord in undulating thicknesses, so as to produce the same form and character as the well-known "coronation braid," and admit of being readily sewn in the requisite figure or design to crape, areophane, cloth, silk, &c. *Patent completed.*

79. E. Agneni. "Increasing the effect of decorative pictures, landscapes, drawings, and prints, through looking glasses." Dated Jan. 11, 1859.

Here the inventor engraves the outline of a painting, &c., upon the quicksilver, of looking-glasses, or upon any other substance employed in manufacturing the same. He scratches out the quicksilver and applies upon the cleared part the artistic production. *Patent completed.*

80. C. M. Kernot. "Improvements in purifying and decolorising paraffine, and rendering the same white, hard and sweet." Dated Jan. 11, 1859

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To separate the paraffine from the tar, and thus purify it, the inventor applies sufficient heat to the crude paraffine to melt the paraffine which it contains without melting the tar, and he then subjects the melted material to filtration, when the paraffine will pass through the filter, leaving the tar behind. *Patent completed.*

81. J. Biers, jun. "A self-acting carriage wheel break." Dated Jan. 11, 1859.

This consists in giving to the fore carriage, by slots or otherwise, a longitudinal motion as well as the present rotary one. *Patent completed.*

82. B. Robbins. "Improvements in the machinery for working pumps." Dated Jan. 11, 1859.

To apply this invention to (say) a pair of pumps, above the pumps mounted upon suitable framing is a horizontal beam or cross-head, which works on a transverse axle in the centre of its length, and to the ends of which the pump rods are jointed. Formed on, or rigidly attached to, the under side of the balance beam is a toothed segment, which gears into a second toothed segment formed on the head of a pendulous lever, which has its fulcrum below and in a vertical line with the axes of the horizontal beam or cross-head. A vibratory motion in the direction of the length of the balance beam is communicated to the pendulous beam by a transverse horizontal cranked shaft, the crank of which is coupled to its lower limb, or the crank pin may work within a vertical slot formed in the lower portion of the lever. Rotary motion is given to the crank shaft by a spur wheel staked thereon gearing into a toothed wheel on the driving shaft, which is parallel to the crank shaft, and is provided with a fly wheel and so forth. The power is applied thereto by crank handle or other mechanism. *Patent completed.*

83. W. Tillie. "An improvement in the manufacture of shirts and shirt fronts." Dated Jan. 11, 1859.

This consists in a method of arranging the plaits of the fronts of shirts, so that a less quantity of material is used than in those made in the ordinary way. *Patent completed.*

84. D. E. Hughes. An improved mode of insulating electrical conducting wires. Dated Jan. 11, 1859.

The principal object here, is to maintain the insulation of submarine telegraph wires after the gutta-percha, &c., has become impaired. One mode by which the inventor attains the desired end, is to insert in the gutta-percha tube that encloses the conducting wires a semi-fluid or soft non-conducting material, which, when the gutta-percha coating is pierced or cut, will ooze out and fill up the fissure. *Patent completed.*

85. B. J. Rubenstein. "Improvements in dentistry." Dated Jan. 11, 1859.

This consists in the application of gold plates, as base pieces beneath artificial gums of hippopotamus tusk (or the tusk of the sea horse,) or ivory. The inventor employs tortoiseshell in certain cases as a substitute for metal plates of various kinds and shapes used in connection with artificial teeth. *Patent abandoned.*

86. R. and W. Hawthorn. "Improvements in apparatus for promoting combustion, and preventing smoke in coal-burning locomotives, and other steam-boiler furnaces." Dated January 11, 1859.

According to this invention, it is proposed to employ a number of inclined deflecting plates fitted to the doors or other parts of the fire-box or furnace. Deflecting pieces may be interposed between the plates for deflecting the air right and left over the surface of the fuel. It is also proposed to use an arrangement of steam jets to be introduced into the fire-box or furnace through the back part, and on each side of the fire-doors to a little above the surface of the fire. *Patent completed.*

87. C. W. Siemens. "Improvements in supports for electric telegraph line wires, and in tools or apparatus to be used in the construction of such supports, part of which improvements are applicable to the joining of pipes and other articles." Dated January 11, 1859.

This invention comprises a variety of details which are described in the specification at too great length to be reproduced here. *Patent completed.*

88. S. Versmann and A. Oppenheim. "Improvements in rendering fabrics and substances non-inflammable." Dated January 11, 1859.

This consists in rendering fabrics, and other matters of an inflammable nature, non inflammable, by the application thereto of sulphate of ammonia. *Patent completed.*

89. N. P. Burgh. "Improvements in steam-engines." Dated January 11, 1859.

This consists in substituting for the ordinary trunk and piston arrangements a piston having an opening in the centre for a trunk or tube of a parallelogram or other convenient form to pass through, or slide upon. *Patent completed.*

90. P. Bouche. "Improvements in the used means for mechanically raising up the gowns of ladies and young ladies." Dated January 12, 1859.

Here a girdle or waist band, made of some strong fabric, is worn under the gown, but independent thereof, being kept round the body of the wearer by hook and eye, or similar attachment, and it has suspended from it two cords or strings, so that both ends of each cord or string hang down. At about equal distances apart on the inside of the skirt four tapes are attached in an upward direction, each of which has formed in it three or four eylet holes, through which are passed the ends of the cord hanging down from the girdle, and having attached to it at bottom one or more wooden or other balls of sufficient weight for keeping the cords distended. The cords may also pass over little wheels or pulleys fitted in a steel or whalebone band attached to the end of the girdle. *Patent abandoned.*

91. W. and W. T. G. Bray. "Improvements in locomotive and traction engines." Dated January 12, 1859.

This invention is not described apart from the drawings. *Patent completed.*

92. W. Oliver. "Improvements in boats, and in the mode of propelling them." Dated Jan. 12, 1859.

This consists in employing paddle wheels placed on either side of the boat, and connected through the medium of a crank shaft, to which motion is communicated through the intervention of treadles; the said wheels moving in either direction, and one or both of the same actuated at pleasure by the use of a slide rod motion and disconnecting gear, whilst for the convenience of steering the yoke lines are brought round and secured in the front of the operator, who sits with his face towards the bows. *Patent completed.*

93. J. Thomson. "Improvements in the manufacture of rings," Dated Jan. 12, 1859.

This relates to the manufacture of what are technically known as "beam rugs," entirely or chiefly from jute or jute-hemp. The essence of the invention is the application and use of jute, or jute-hemp in the portion of the warp which is made to form the pile or shag in the manufacture of beam rugs. *Patent completed.*

94. J. Hands. "Improvements in preserving or preparing skins intended to be converted into leather, or otherwise manufactured." Dated Jan. 12, 1859.

This consists in a mode of preserving or preparing skins intended to be converted into leather, by subjecting them to the action of gaseous binoxide of nitrogen, nitrous acid gas, and sulphurous acid gas, either separately or combined. *Patent completed.*

95. J. Gibbons. "Improvements in fixing door and other knobs." Dated Jan. 12, 1859.

Here the outer end of the male screw has a moveable cover applied to it, which is separated from the projection on the fixed rose, and also separate from the female screw in the moveable or covering rose. This cover and the fixed rose are made with notches, slots, recesses, &c., which when they come together and are in use connect the cover with the hollow male screw or other parts of the fixed rose, so that the cover will be prevented turning when the knob is turned, and such connecting of the cover with the fixed rose on the door, may be such that the pull to open the door may be on the fixed rose without acting on the covering rose. *Patent completed.*

96. S. Canning and H. Clifford. "Improvements in machinery for paying out and for recovering or picking up submarine telegraph ropes, cables, or chains." Dated Jan. 12, 1859.

This consists of one or more grooved pulleys or rollers, each having a jockey pulley or roller with levers working into it. These levers may be either simple or compound, and are raised or lowered by screw or other gear for regulating the speed in paying out or picking up cables, ropes, or chains. On the shaft of each of the grooved pulleys or rollers a break or friction wheel is fixed, fitted with friction straps of wood, leather, &c.; or the patentees fix on each shaft of the grooved pulleys or rollers a friction roller with another intermediate roller running between or on them. This intermediate roller is so arranged that it is capable of being raised or lowered by lever screw or other gear, so as to press down on the other friction rollers, acting both as brake or friction roller, or as the means of connecting together the grooved pulleys or rollers. *Patent abandoned.*

97. T. Elwell. "Improvements in governors for steam engines and other motive power engines." Dated Jan. 12, 1859.

The patentee claims, 1, the method of constructing governors for steam engines, and other motive power engines, essentially as described with reference to the drawings. 2. The method of transmitting motion to the expansion slips of steam engines and other motive power engines by means of two pairs of friction surfaces constructed and arranged with other operating parts essentially as described and illustrated in the drawings. *Patent completed.*

98. W. and W. McNaught. "Improvements in steam engines and in apparatus connected therewith." Dated Jan. 12, 1859.

This invention is not described apart from the drawings. *Patent completed.*

99. S. Phillips. "Improvements in fastenings for securing windows, shutters, and doors, and for other similar uses." Dated Jan. 12, 1859.

This consists in one of its forms of a spring cotter pin made of a length of metal doubled back to form a spring; each end of the metal thus doubled being furnished with half a knob or thumb piece, so that when the spring is compressed the end intended for the hand to act upon has the appearance of being terminated with an ornamental knob or thumb piece. *Patent abandoned.*

100. R. Mushet. "A new or improved metallic alloy." Dated Jan. 12, 1859.

This consists of an alloy composed of cast iron and metallic tungsten. *Patent completed.*

101. R. Mushet. "A new improvement or improvements in the manufacture of cast steel." Dated Jan. 12, 1859.

This consists in alloying cast steel with the metallic tungsten, by which the quality of the steel is improved. *Patent completed.*

102. C. N. May. "Improvements in sluice valves." Dated Jan. 12, 1859.

This relates to valves having double faces, and which act by pressure approaching either in one direction or the other. Both faces of these valves are brought into contact with the faces of the valve case or passages simultaneously, by reason of their wedge form or inclination to each other, which is also the case with the valve. According to this invention the inventor makes such valves to move on a centre, and disposes them in a semi-circular case, from which they may be removed by a suitable cover. He communicates motion to such valves by a segment of teeth on the periphery and pinion on the handle shaft, or it may be by a tangent screw or other means and whereby to force the valve home or remove it from between the edge faces inclosing or opening such valves. He mounts these valves so as to perform their motion on a centre pin, which the valve embraces sufficiently to form a secure fulcrum, but from which it can be lifted when it is desired to remove the valve from its case for repairs. *Patent abandoned.*

103. C. Beslay. "Improvements in coating or covering iron or steel with tin, zinc, or lead, or alloys of shale metals by electrical deposit." Dated Jan. 12, 1859.

The inventor coats iron and steel by the direct deposit thereon (by electrical agency) of the coating metal or alloy which adheres firmly thereto, and no tendency to oxidation is produced, and whereby a firm and durable coating is applied to the iron or steel. For the batteries he employs solutions of caustic soda or potash, instead of acids. *Patent completed.*

104. C. N. May. "An improved heat indicator." Dated Jan. 13, 1859.

This consists of an external face or dial upon which are marked figures indicating the degree of heat to which the apparatus is exposed. Internally there is a semi-circular compound lever of brass and steel, one end of which is firmly screwed to the frame or case of the apparatus; the other end, which is free to move, presses upon the short end of a lever, the opposite end of which carries a toothed segment gearing into a pinion on the axis of a pointer which traverses round the dial face. At ordinary temperatures this pointer stands at zero, but the action of heat upon the compound metal bar causes it to expand and press upon the lever, giving motion through the toothed segment and pinion to the pointer, which moves round the dial until it points to a number that indicates the heat of the oven. By this apparatus the heat of an oven may be easily regulated. *Patent completed.*

105. R. A. Lightoller. "Certain improvements in machinery or apparatus for spinning cotton or other fibrous materials." Dated Jan. 13, 1859.

This consists in the use of a first train of gearing for driving the drawing rollers, and running or drawing out the spindle carriage for the first stretch, when a double-acting coupling is thrown out of gear and into gear with a second or slower motion, so as to turn the drawing rollers and advance the carriage together at a slower speed, during which time the

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second stretch is produced, and the drawing rollers can be stopped by a second and independent coupling or catch box, and the carriage still continue its motion outwards until its catch box is thrown out of gear. *Patent completed.*

106. W. BENNETTS. "Improvements in mechanism used for preventing accidents when raising or lowering skips, baskets, or apparatus particularly applicable to mines." Dated Jan. 13, 1859.

Here the skip or basket is so suspended that, immediately a breakage takes place, two projections which move on axes are pressed outwards by springs against the wood framings, and so as to retard and arrest the downward movement. *Patent completed.*

107. W. H. CRISPIN. "Improvements in the construction of ships and other sailing and steam vessels." Dated Jan. 13, 1859.

Here the hull of the ship is constructed of iron, the same being covered internally and externally with wooden planking bolted through the iron and wood, and so arranged as to break joint. The decks may be constructed upon the same principle. *Patent abandoned.*

108. H. CRITCHLEY and S. ELSTON. "Certain improvements in pistons for steam engines, or other purposes." Dated January 13, 1859.

This relates particularly to the arrangement of a series of small cylinders or recesses contained within the interior of the piston; also to the peculiar construction of the several parts connected therewith for the cause of isolating or confining from the action of steam, &c., the means whereby a uniform and continuous pressure is constantly exerted upon interior of cylinder in which such piston works. *Patent completed.*

109. G. SCOPES. "Improvements in apparatus for communicating motion to cots, cradles, and other articles for children's use." Dated January 13, 1859.

This consists in giving motion to cots, &c., by a spring and train of wheels, exactly as the motion is given to the pendulum of a clock. *Patent abandoned.*

110. J. PICKSLEY and R. SIMS. "Improvements in lawn-mowing machines." Dated January 13, 1859.

This consists, 1, in forming the rollers of the full length of the cutters; 2, in disposing the driving wheels so as to work outside the frame, at the same time those wheels are entirely or partially encased so that nothing can come in contact with them; 3, in adapting a carrying or supporting ball or balls in front of the machine as a substitute or substitutes for the wheel or wheels, or rollers of such machines, whereby it is readily and easily suited to operate on large or small lawns, as well as on narrow verges, or borders, or detached spaces; 4, in mounting and fitting the front part of the machine so as to elevate or depress the cutting parts across the whole breadth by means of racks and pinions, screws, or other means for giving simultaneous motion to both sides of the machine. *Patent abandoned.*

111. W. H. MORRISON. "Improvements in wind musical instruments." Dated January 13, 1859.

This applies to those instruments in which the sound is obtained by blowing through a mouth-piece, and consists in adapting to such mouth-piece a flexible and elastic receiver which is to be filled with air by blowing through the opposite end of the instrument, or through an opening otherwise suitably placed. The air thus forced into the receiver will then by the elasticity of such receiver have a tendency to be forced back through the instrument to produce the required sounds; a stop catch, or other regulator may be applied. *Patent abandoned.*

112. D. L. BANKS. "A method of constructing a travelling suspension rail or roadway, applicable among other uses, as a bridge and lifting agent." Dated Jan. 13, 1859.

The inventor describes a method of constructing a travelling suspension rail or roadway which cannot well be explained without reference to drawings. *Patent completed.*

113. J. J. STEVENS. "Improvements in railway signal apparatuses." Dated January 13, 1859.

The patentee claims, 1, the construction of railway signal posts or pillars of wrought or cast-iron; 2, certain means for raising and lowering the lanterns in railway signalling apparatuses; 3, certain means of and apparatus for compensating for the expansion and contraction in the wires, and to work signals at a distance; 4, an arrangement of compensating apparatus to be placed at some point between the ordinary lever and the signal; 5, an arrangement of signalling apparatus to be worked by a passing train, all as described with reference to the drawings. *Patent completed.*

114. F. J. MANCHAUX and E. N. VIEILLARD. "Improvements in breech-loading fire arms and in cartridges." Dated Jan. 13, 1859.

The patentees claim, 1, the use in breech-loading fire-arms of two plugs, one of which is hollowed out conically, and the other of which is solid, and has a conical exterior entering partly into the hollowed-out portion of the former, the two plugs being connected by a threaded stem and a nut or other equivalent means, so that while the explosive force of the powder is free to drive the inner plug further into the outer plug, and thus close the breech effectually, the inner plug is not at liberty to leave the outer plug when the said force is removed. 2. The use of a projection formed upon the face of the inner plug, in order to provide for the admission of the explosive gases behind the cartridge, whereby the expulsion of the whole of the said cartridge is effected. 3. The construction of cartridges as described with reference to the drawings. *Patent completed.*

115. J. GRIST. "Improvements in machinery for cutting and shaping staves and heads for casks, and for the manufacture of casks." Dated Jan. 13, 1859.

The specification of this invention describes the arrangements of machinery used in detail with the aid of drawings, and is too elaborate to be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

116. W. A. CHADWICK. "A musical instrument chiefly for teaching the intervals of musical scales." Dated Jan. 13, 1859.

This instrument is composed of a hollow box or shell the two sides of which are connected internally by a sound-post; two or more apertures or sound-holes are made in one of the sides, and a base bar is also fixed inside. On the top side of the case the inventor fixes a rail or finger-board with the places at which to stop for notes indicated by pins or studs. A string or wire is attached at one end of the rail and is carried along over the rail and over a bridge near the opposite end thereof, it then passes through a slot in the rail and is attached to a nut, which is adjusted by a thumb screw, so as to regulate the tension of the string. Sound is produced by a bow similar to that of a violin, which will vary according to the part of the string at which it is stopped by the finger. *Patent abandoned.*

117. W. WILSON. "Improvements in machinery for felting bodies of hats and bonnets." (A communication.) Dated Jan. 13, 1859.

This consists chiefly in the use of iron cylinders (lined with lead) supported by an iron frame at each end. Through the length of each cylinder four grooved wooden rollers are placed, so as to cross each other, the ends passing through the iron frame. These cylinders are actuated by suitable mechanism, giving to the grooved rollers the needful oscillating movement, and between these grooved rollers the bodies to be felted are passed. *Patent completed.*

118. T. HERBERT and E. WHITAKER. "Improvements in the manufacture of warp lace." Dated Jan. 13, 1859.

Here three warp threads work with a needle, two of which are called twisting threads and one a pillar thread, and in the working of the machine one of the twisting threads is caused to lap over a needle, and the other twisting thread is caused to traverse under the same, and both threads are caused to rise up and to pass back over the same needle, by which means the first-mentioned twisting thread will be over-lapped from the needle, and the second-mentioned twisting thread will be lapped in the needle, and the two twisting threads will be twisted together. The pillar thread is then caused to lap on the needle, and its lapping is passed under the beard of the needle; but the lapping of the twisting thread is knocked over with the previous loop of the pillar thread. *Patent completed.*

119. O. ROWLAND. "Improvements in laying electric telegraph wires in streets." Dated Jan. 13, 1859.

Here the inventor employs iron troughs furnished with covers so constructed as to form part of the pavement of a street. *Patent abandoned.*

120. J. BARRANS. "Improvements in traction and portable steam engines." Dated January 13, 1859.

This consists chiefly in supporting the boiler and cylinders on a beam or lever; in the application of india-rubber springs to certain parts of the engine and in driving the driving wheels by pinions gearing into cog-wheels fixed to the driving wheels. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 29, 1859.

1545. W. and J. Wray. Certain improvements in reaping machines.

Dated July 13, 1859.

1656. W. A. Munn. Improvements in reaping machines.

Dated July 20, 1859.

1708. Z. G. A. N. P. Orioli. New applications of hypochloride of alumina to bleaching and dyeing, and to the disinfection and preservation of organic matters.

Dated July 21, 1859.

1710. H. B. Preston. Improvements in apparatus for superheating steam.

Dated July 28, 1859.

1752. J. Aspinall. Improvements in evaporating and in apparatus for the same, especially applicable to the evaporation of sugar.

Dated July 29, 1859.

1760. S. Wilson. Certain improvements in the construction of presses for compressing cotton and other articles.

Dated July 30, 1859.

1766. F. Haeck. Improvements in refrigerating apparatus, especially adapted to pumps or other apparatus for the supply of beer and other liquids.

1772. W. Jamieson. An improved churn. A communication.

Dated Aug. 1, 1859.

1774. W. Campbell and G. Worstenholm. Certain improvements in machinery for the manufacturing of wrought nails, as also in the treatment of the iron from which such or other kinds of nails may be made. A communication.

1776. T. W. G. Treeby. Improvements in targets.

1780. W. E. Newton. An improved mode of and apparatus for making metal cylinders suitable for steam boilers, and other purposes. A communication.

Dated Aug. 2, 1859.

1786. B. Donkin. Improvements in and in connection with slide and other valves. A communication.

Dated Aug. 3, 1859.

1787. A. Pin. The compounding, preparing, and application of a new sort of paint.

1788. J. Hewett. Improvements in self-acting water-closets.

1789. W. K. Peace. An improvement in canisters for hermetically sealing paints and other substances. A communication.

1790. M. Mason. Improvements in machinery for printing, and in apparatus connected therewith.

1791. W. H. Tooth. Improvements in machinery or apparatus for the manufacture of iron or steel.

1793. J. Petrie, jun. Improvements in machinery or apparatus for washing wool.

1794. J. H. Phipson and W. A. Watson. A new or improved lubricator for lubricating shafts and other articles requiring lubrication.

1795. W. H. M. Blews. A new or improved regulator for gas burners.

1796. E. Dowling. Improvements in rosettes or ornaments applicable to harness, and for other purposes.

Dated Aug. 4, 1859.

1797. T. Lister. An improved sanatory water-closet.

1798. J. Horton. A new or improved water-gauge for steam-boilers.

1799. R. A. Brooman. Improvements in mills for grinding coffee, corn, and other substances. A communication.

1801. F. Walton. Improvements in the manufacture of ornamental fabrics suitable for book binding and other uses, and in machines employed in such manufacture.

Dated Aug. 5, 1859.

1803. E. B. Gowland. Improvements in pianofortes.

1804. E. Swainson. Certain improvements in looms for weaving.

1805. N. D. Maillard. Improvements in compasses for indicating the course and time of ships at sea, without the use of needles or magnets.

1807. N. Berry. An improvement in the manufacture of knitted fabrics. A communication.

1809. W. E. Newton. An improvement in billiard and bagatelle cues. A communication.

1810. F. W. Beaumont. A hydraulic apparatus, applicable to transmitting, regulating, and measuring the supply or flow of liquids.

1811. W. Thompson. An improved printing telegraph.

Dated Aug. 6, 1859.

1815. A. B. Childs and L. D. Owen. Improvements in machinery for cleaning grain and seeds from smut and other extraneous matter.

1816. A. T. De Lisle. Improvements in clarifying and decolorizing solutions of sugar and other liquids.

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1817. E. A. Süwerkrop. Improvements in reaping and mowing machines. Partly a communication.

1818. A. F. Delannoy. Improvements in lubricating the axles or journals of wheels, also applicable to lubricating apparatus for the transmission of motion in general.

1819. J. W. Welch. Improvements in machinery or apparatus for sizing or dressing yarns or threads for weaving.

1820. E. T. Hughes. Improvements in machinery or apparatus for manufacturing chenille. A communication.

Dated Aug. 8, 1859.

1821. J. Weston. Improvements in breaks for railway carriages, and in the method of applying the same, and in conveying signals from one part to another of the same train, parts of which are applicable to breaks for other purposes.

1823. H. Liddle. Improvements in machinery or apparatus for polishing yarns or threads.

1829. J. H. Johnson. Improvements in apparatus for steering ships, applicable also in all cases where a rotatory or partial rotatory motion is required. A communication.

1831. B. S. Cohen. Improvements in ever-pointed pencils.

1833. T. and R. Blinkhorn. An improved composition for removing scale or fur from the interior of boilers, and also for preventing the formation of scale or fur therein.

Dated Aug. 9, 1859.

1835. T. Dunn. Improvement in machinery and apparatus for elevating and regulating the level and flow of liquids, part of which is applicable for propelling vessels.

1837. P. F. Rolland. A new electric telegraph.

1839. I. Mitchell and S. Lister. An improvement in apparatus applicable to machinery for spinning fibrous materials.

1841. J. B. Badcock. Improvements in bustles and skirts. A communication.

1843. J. D. Bryant. Improved superphosphate of lime.

1845. B. Browne. Improvements in the manufacture of paints and pigments. A communication.

1847. W. Mac Lellan. Improvements in parts of the permanent way of railways. A communication.

Dated Aug. 10, 1859.

1849. W. Muir. Improvements in machinery for communicating motion to foot lathes and other machines to be worked by treadles.

1851. W. K. Westly. Improved machinery for combing, heckling, and preparing to be spun flax and other fibrous substances.

1853. A. Shaw. Certain modes or methods of preparing sheep or other skins or pelts, or the linings thereof, and for raising nap on the same, and also for preparing the said skins for kid leather, and for enamelling and japanning the same.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Aug.* 23, 1859.)

898. B. Baugh. Fly presses.
904. A. Bower. Keels of vessels.
905. W. Rowan. Spinning.
906. R. A. Brooman. Candle moulds. A communication.
907. W. S. Clark. Loading ships.
909. J. Marland. Cop tubes.
925. H. Eckhorn. Lamp regulator.
929. A. R. Johnson. Instrument for damping.
930. J. A. Coffey. Heating liquids.
932. J. L. Stevens. Fire-grates.
936. T. Bird. Lubricating.
941. E. Dowling. Weighing machines.
943. A. McDougall. Coating metallic surfaces.
944. L. J. Higham. Billiard tables.
952. H. Barrow. Fastening.
955. L. Collier. Feeding apparatus.
958. J. Hamilton. Regulating prime movers.
959. A. Courage. Obtaining metallic particles from smelting works.
968. R. Warry. Projectiles.
969. W. Prosser. Production of light.
971. J. Whitaker. Mowing machines.
972. J. Seaman. Cultivating the soil.
977. J. Freer. Planting machines.
987. I. Dutton, R. Martin, and T. Phillips. Machinery for preventing accidents.
994. J. M. and E. Johnson. Ornamental surfaces.
995. A. W. Williamson. Obtaining extracts.
1007. E. Lewtnwaite and G. Ambler. Timekeepers.
1031. G. Ward. Making healds.
1082. W. Winstanley and J. Kelly. Pumps.
1134. W. E. Newton. Steam gauge. A communication.
1135. W. E. Newton. Fish hooks. A communication.
1295. A. V. Newton. Rivets and bullets. A communication.
1327. E. Breffit. Corks.
1334. J. L. Norton. Fabrics.
1694. A. Phillips. Fabrics.
1738. J. Gillott and J. Morrison. Penholders.
1765. J. Wood. Truss for hernia.
1777. T. G. Messenger. Horticultural buildings.
1803. E. B. Gowland. Pianofortes.
1817. E. A. Süwerkrop. Reaping and mowing. Partly a communication.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 19, 1859.

506. J. Dale.
513. W. McNaught.
523. E. Gatwood.
531. C. and C. Hall.
559. J. Newcomb and J. G. Lovell.
631. J. Cunliffe, F. Piggott, and G. Mallinson.
650. C. Desurmont and C. Goudeau.
673. C. Garnett.
758. W. E. Newton.
810. F. Morton.
812. A. V. Newton.
911. D. Doig.
1075. W. M. Cranston.
1201. T. and T. Vicars. T. Ashmore, and J. Smith.

Sealed August 22, 1859.

521. J. Hine.
524. F. Brignoles.
536. E. J. Hughes.
537. T. Cloake.
541. J. Edwards.
543. J. Templeman.
545. D. Lichtenstadt.
559. R. H. Collyer.
618. J. S. Dawes.
1026. W. Moxon and J. Bennett.
1437. A. V. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

1931. C. M. Chouillou.
1933. H. Burden.
1937. R. Johson.
1950. J. Maudslay.
1953. T. York.
1976. M. A. F. Mennons.
1992. A. V. Newton.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Aug. 19, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
79	0 3	91	1 1	102	0 3	113	1 10	124	0 3	135	0 3
81	1 10	92	0 6	103	0 3	114	0 6	125	0 10	136	0 3
82	0 6	93	0 3	104	0 5	115	1 10	126	0 5	141	0 7
83	0 3	94	0 4	105	0 9	116	0 3	127	0 10	143	0 4
84	0 4	95	0 10	106	0 7	117	0 9	128	0 3	145	0 5
85	0 3	96	0 3	107	0 3	118	0 3	129	0 6	146	0 3
86	0 10	97	0 7	108	0 6	119	0 3	130	0 3	147	0 6
87	1 6	98	1 5	109	0 3	120	0 10	131	1 4	151	0 7
88	0 3	99	0 3	110	0 3	121	0 7	132	0 4	...	...
89	0 11	100	0 4	111	0 3	122	0 4	133	0 10	...	...
90	0 3	101	0 5	112	0 10	123	0 3	134	0 5	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design
July 29,	4191	J. Chandler, Deptford...	Water guage.
,, 30,	4192	J. Dookree, Kingsland	Funnel valve.
Aug. 1,	4193	Williams and Biven, Reading	Valve.
,, 17,	4194	Cooper and Smith, Ashbourne	Fastener.
,, 19,	4195	J. Caddick, Birmingham	Candlestick.

PROVISIONAL REGISTRATIONS.

July 25,	1091	H. J. and D. Nicoll, Regent-street	Belt.
Aug. 2,	1092	R. R. Cox, Regent's-pk.	Circler-shifter.
,, 9,	1093	E. & J. Turner, Sheffield	Vice.
,, 9,	1094	Gregory and Redfern, New Cut	Fire-escape.
,, 10,	1095	J. Cark, jun., Leeds...	Slate machine.
,, 22,	1096	J. Fairley, Worcestershire	Washing apparatus.
,, 24,	1097	H. Wilkinson, Cumberland	Churn.
,, 24,	1098	M. Boyle, Queen's-sq. ...	Trunk.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

RAILWAY, *Llynri Valley.*—Diversions of portions of the line. Plans at the Company's Office at Porth Cawl. Tenders to August 31st.

DEFENCES, *Drop Redoubt, Dover.*—Candidates desirous to tender for the above works must signify their intention at the Royal Engineer office, Dover, before September 3rd, where terms may be known. A meeting of candidates, to elect a surveyor, will be held at the Royal Engineer Office, Dover, at 12 o'clock on Thursday, August 25th.

GUARD HOUSE, *Dover.*—Candidates desiring to tender must signify their intention at the Royal Engineer office, Dover, until August 27th. Bill of quantities, half-a-guinea. Tenders to September 5th.

MATERIALS, *Dover.*—And performance of such bricklayers', masons', paviours', carpenters', slaters', smiths', plasterers', plumbers', painters', glaziers', and paper-hangers' work required by the Royal Engineer Department at various stations of the Dover district from September 1859 to March 1860. Only one contractor will be accounted for all the trades at each station, and parties tendering must state according to the printed directions, the rate at which they are willing to perform the work. Printed schedules and all particulars at Royal Engineer office, Hythe, to September 5.

HYDRAULIC MAIN, *Sowerby Bridge.*—36 feet long, and 30 inches diameter, for 20 retorts; also exit, H and P.a pipes, all complete. Plans, Sowerby Bridge Gas Works. Tenders to August 29.

GASHOLDER, *Teignmouth.*—With cast-iron tanks, a vertical condenser, a scribbler, governor, &c. Plans, &c., office of Mr. Wm. Cotton, Surveyor, Teignmouth. Tenders to August 30th.

CHURCH, *Downton, Herefordshire.*—Plans, &c., office of Mr. S. Poutney Smith, Shrewsbury.

CHAPEL, &c., *Edinburgh.*—For the erection of a chapel, school, and schoolmaster's quarters at Piershill barracks, Edinburgh. Tenders to the Director of Contracts, War Department, Pall Mall, London, September 12.

PARSONAGE, *Kirton Lindsey, Lincolnshire.*—Plans, &c., with Rev. F. Stuart, Kirton Lindsey. Tenders to September 6th.

SCHOOLS, &c., *Liverpool.*—For the erection of parochial schools and teachers' residences for the parish of West Derby, near Liverpool. Drawings, specifications, &c., Mr. H. P. Horner, architect, 10 Bassnett-street, Liverpool, where tenders. No date supplied.

SCHOOLS, *Brandon, near Durham.*—Plans at the office of Mr. Dobson, architect, Newcastle-upon-Tyne, and at the Rectory, Brancepeth, near Durham. Tenders to August 27.

ASYLUM, *Alterations, Worcester.*—Including reservoir, pump-well, water tower, steam engine, boilers, &c. Plans at office of Mr E. L. Williams, C.E., Diglis, Worcester. Tenders to September 3rd.

HOUSES, *Spaldington, near Howden.*—Upon the estate of Sir Henry Mervyn Vavasour, Bart., at Spaldington. Plans, &c., Messrs. Stephens and Robinson, architects, 17 Tennet-street, Derby. Tenders to September 7th.

LAUNDRY, *Chichester Barracks.*—Plans, &c., Royal Engineer's Office, Portsmouth. Tenders to September 6th.

CART SHED AND TOOL HOUSE, *Poplar District.*—For the erection and completion of a cart shed and tool house, in the stone yard, St. Leonard's-road, Bromley. Forms of tender, Mr. C. C. Cecly, clerk to the board, East India Dock-road; where tenders September 6.

SEWERAGE, *Crumpsall.*—250 yards of Tyson-street. Plans, &c., of Mr. Bell, surveyor, 51 King-street, Manchester. Tenders to the chairman, J. Knott, Esq. (Overseers' offices) Crescent-road, Crumpsall. Tenders to September 10th.

SEWERS, *Poplar District.*—For laying down sewers in the parish of Bromley. Willis-street and Dessart-street, 654ft. run, 12in. patent pipe; Tetley, Randall, and Cawdor-streets, 663ft. run, 12in. patent pipe; with the requisite gullies and connections. Tenders, noon, September 6, with Mr. C. Cecly, clerk to the board, East India Dock-road, where forms of tender.

PIPE DRAINAGE, *Trentham, North Staffordshire.*—For excavating and laying down about 1,600 yards of 9-inch drain pipes. Apply to Mr. Roberts, Trentham office. No date given.

METAL ROLLER.—One to undertake the management of a mill. Apply to Mr. S. Walker, Rolling, Tube, and Wire Mills, Lower Fazely-street, Birmingham.

MACHINIST.—One accustomed to fine drilling, acquainted with perforating tools, and accustomed to making apparatus for working same. Address by letter, C. B., at the *Daily Post Office*, Birmingham.

PUDDLERS AND UNDERHANDS.—Good characters for steadiness and ability necessary. Apply to Mr. J. Brown, Lower Furness Iron and Steel Works, Ulverston.

LAMP MANAGER.—One who understands the manufacture of lamps and arrangement of stock. Apply to J. Taylor and Sons, Warwick-lane, Newgate-street, London.

GAS CHANDELIER MAKERS.—Several first-rate, and two burnishers. Apply to Benjn. Vickers, Atlas Works, Sheffield.

MILLWRIGHT.—To superintend the machinery and make patterns. Apply to E. J. Hunt, Prince of Wales Ironworks, Millwall, Poplar, London, E.

HEAD FOREMAN.—Thoroughly acquainted with smiths' work, and the fitting necessary for iron bridges, roofs, tanks, &c. J. H. Porter, ironworks, Gas-street, Birmingham.

ENGINEER'S DRAUGHTSMAN.—A draughtsman of superior ability and great experience in marine engine work. Applications, with every particular, E. D., care of Messrs. Hammond and Nephew, 27 Lombard-street, London, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 2, 1859.

THE NATIONAL DEFENCE COMMISSION.

HER gracious Majesty, having thought it expedient, for divers good causes and considerations, that a Commission should forthwith issue, and that inquiries may be made by her Commissioners into "the present state, condition, and "sufficiency of the fortifications existing for the "defence of her United Kingdom, and of [*sic*] "examining into all works at present in progress "for the improvement thereof, and for [*sic*] con- "sidering the most effectual means of rendering "the same complete, especially all such works "of defence as are intended for the protection "of our Royal arsenals and dockyards in case "of any hostile attack being made by foreign "enemies both by sea and land," has appointed Major-General Sir Harry D. Jones, K.C.B., Major-General Duncan A. Cameron, C.B., Rear-Admiral Elliot, Major-General Sir Frederick Abbott, K.C.B., Captain Astley Cooper Key, R.N., C.B., Colonel J. H. Lefroy, and James Fergusson, Esq., to be her Commissioners for the purpose of such inquiries as aforesaid; and for their assistance in the due execution of these duties has made choice of Major William Francis Drummond Jervois, to be Secretary to this Commission, and to attend them and aid them with his services and assistance.

According to our great national defence authority—the *Times*—"the constitution of "this Commission provides a very fair repre- "sentation of all branches of the two services; "nor will it escape notice that Mr. James Fer- "gusson participates in the honour of the ap- "pointment, so that the 'Perils of Portsmouth,' "if they really exist, can now be taken into "effectual consideration." Now, against Mr. Fergusson's appointment we have not a syllable to say, for there is probably not a civilian in England who has studied the subject of national defences more closely or more intelligently than he; and we happen to know that he has very recently gone minutely into the question in an article which has excited a good deal of attention—in our own columns and elsewhere. But we certainly must say that by placing a single civilian only upon the Commission, and by making "fortifications" the only subject of its inquiry, the Government have gone a very short way towards satisfying our desires in this matter. Without asking whether in Sir Harry Jones, General Cameron, Sir Frederick Abbott, and Colonel Lefroy, we have four of the foremost military men of the age, or whether Admiral Elliot and Captain Key are to be ranked among our greatest naval authorities, we are entitled to say that four military and two naval officers, with a single civilian thrown in, cannot possibly arrive at a satisfactory solution of the vast question of our defence.

We are prepared, in fact, to assert that by the appointment of the Commission now before us, the attention of which is to be confined to land defences, the greatest causes of our recent fear and dread are ignored. Were the times not exceptional — did we apprehend nothing more now than our fathers of a century since had to look for — a mere military and naval Commission might answer our purpose. But the only men in whom we can now confide are men fit to grapple with the altered condition of things that characterises this strange age. The very first thing we want decided is, how we shall meet the new forms of danger to which the creation of steam fleets has exposed us. Will this Commission settle that question for us? Then, again, we want to know what is to be done in regard to iron-plated vessels—whether we are really to begin building them, or stick to our wooden walls. Will this Commission resolve us this doubt? Then, again, we wish to be informed how many millions we are to spend on our new rage for line-of-battle ships, and whether gunboats are really to be held in esteem or not. Will this Commission say yea or nay to these things? And so we might go on naming subject after subject in reference to which all the intelligent people in the country stand dumbly doubting and waiting, but upon which this Commission cannot possibly yield us any kind of reliable conclusions. In short, in an age when the progress of science is changing all things, Her Majesty's Ministers have appointed a Commission which, it may with certainty be predicted, will end by prescribing change in nothing. When a strong apprehension of danger can prompt us to no better action than this, we may well pray that evil may be kept far from us. If we have nothing more in the shape of genius to oppose to Louis Napoleon than this Commission presents, we have indeed cause to hope that the powers of the two nations may not be measured against each other in our time.

RIFLED ORDNANCE.

MR. SIDNEY HERBERT, our War Minister, and his colleague, Lord Ripon, have made a ready and graceful concession to the demands of the press, and are taking steps to ascertain the best means of rifling our present cast-iron ordnance without delay. This they have set about in a very novel manner; and, as a temporary expedient, designed to answer a temporary purpose, the plan they have adopted is certainly not a bad one. Knowing but little practically upon the subject themselves, they have turned sharp round upon the gentlemen who profess to understand it, and asked them to show how it is to be done, giving each of them an ordinary 32-pounder to do the best they can with. "Here "Sir William"—says my Lord Ripon to our new Newcastle Knight—"take you this gun, "and rifle it with your cunningest skill, giving "it four grooves or forty as may please you; "and here, Mr. Lancaster, is yours, to receive "whatever ovalling you may think fitting; and "here yours, Mr. Whitworth, to be bored as "many-sided as you may desire; and here "yours, Mr. Nasmyth, and yours, Mr. Thomas, "and yours, Mr. Haddan, and yours, Mr. Britten, "and yours, and yours, and yours." We do hear that no less than fourteen gentlemen, all of whom have professed themselves very clever at this sort of thing, are now boring, and planing, and firing away, with the view of producing the best attainable result with their guns by an appointed day. Then they will meet at Shoeburyness, each with his own gun, and his own special projectile, to make the best practice possible, each in presence of all the others.

Already we have heard (in the *Times'* Naval and military intelligence) of mysterious results attained by Sir William Armstrong, who is said to have fired over 3,400 yards with an ordinary 32-pounder, rifled by himself, hitting a target six feet square at every shot with what the writer calls a "terrific aim" (by which he means, we presume, an "aim with a vengeance.") This is much too good to be true, we fear, for, if true, it would go a long way towards eclipsing the wonderful breech-loading gun itself, and thus saving us all the expense of manufacturing that very costly article.

What the result of this great and singular experiment will be when all the rifled 32's are brought together, it is impossible to predict. That it will be possible to rifle the present cast-iron guns with great advantage we do not for a moment doubt, inasmuch as great results have already been attained by some experimenters. But it appears certain to us that if the guns are to stand, and be reliable after they are rifled, then the rifle grooves must neither be deeply impressed nor have a great turn; otherwise the guns will infallibly burst with elongated projectiles and ordinary charges of powder.

Our opinions of the various systems of Sir W. Armstrong, Mr. Lancaster, and Mr. Whitworth are pretty well known; but of Mr. Haddan's plan, which seems to us not ill-adapted to the present case, we may here say a few words with advantage. Mr. Haddan forms in the gun three shallow "curves," sinking only to about 5-16ths of an inch beyond the circular bore, and wearing off until they lose themselves in the circle of the bore. To these curves he gives a very slight twist—only about one turn in sixty feet, we believe, which is less than that given by any other of the competing gentlemen. His projectile has three swells or projections upon it to take into the grooves, and is formed with a conoidal head and a taper towards the rear end, on which end is placed a simple ring-formed wad. The projectile goes freely into the bore, and when the charge is exploded the centre line of the projectile is compelled by the conditions of the case to occupy the centre line of the gun, and pass out in that position. The projectile can be made as cheaply as any ordinary round shot or shell, being simply of cast-iron; and no great nicety is necessary in adjusting the size of the projectile to that of the gun. The wad is caused to clean out and lubricate the gun at each discharge, and both the gun and the projectiles may be used as roughly as ordinary guns, shot, and shell. Six months since an ordinary 68-pounder gun rifled on Mr. Haddan's plan projected a 90 lb. elongated shell with considerable truth of aim over an average distance of nearly 3,000 yards, with an elevation of ten degrees and a charge of powder of ten pounds, being, as will be seen, only 1-9th the weight of the shell. This was very good practice, and we shall not be surprised to learn that the same system comes out well from the coming test. At any rate, the method of rifling appears to us to be second to none, except perhaps the Lancaster system, for the present exceptional purpose of converting our old smooth bores into rifles, as it will in all probability weaken and distress the gun but slightly.

But however imperative and urgent the task of rifling our old guns may be, it must not be forgotten that when this is done we, as a scientific and enterprising people, and as rivals, in a certain sense, of a scientific and enterprising empire, shall still have much to do. The whole subject of rifled cannon is at present in a most unsatisfactory condition. We have not even so much as brought together anything like an authoritative collection of the principles involved, or which ought to be embodied, in such ordnance. So that even when, by independent invention, a new gun is brought to our notice, we know not what tests to apply to it. Our proceedings with the Armstrong gun illustrate this in a remarkable manner. Here we have not only adopted a gun which soldiers and sailors smile at, as a weapon entirely unsuited to the exigencies of actual warfare, but have put the inventor of it into supreme authority over the whole of the rifled ordnance department; so that nothing is left to us but to put as good a face upon matters as we can, and humbly read in the newspapers that "in

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"Woolwich Arsenal the most implicit confi-"dence is placed in the judgment of Sir William "Armstrong"—while we know that nearly every military man in the establishment is moodily submitting to what is just now inevitable, but is at the same time eagerly waiting to hear that Sir William's splendid and delicate machine is to be superseded by what they would call a gun. We say not that Sir William is wrong and the military men are right. We should be grieved indeed to see a too hasty stop put to the proceedings of our new and unquestionably able rifled-ordnance engineer; but what we do wish to see is a speedy attempt to bring the whole subject better under the control of our knowledge and experience. With the view of furthering this object we will next week quote a chapter on the subject from Mr. Lynall Thomas's new work on rifled ordnance. It contains considerations which deserve the best attention of our war authorities.

THE NEW WORKS DEPARTMENT OF THE ADMIRALTY.

THE damaging letters which Mr. Murray and his colleague Mr. Bowman have published in our columns have brought such a weight of discredit upon the writers that other official gentlemen do not like trying their hands on similar productions. Consequently, although strong objections to our recent article on the New Works Department of the Admiralty have been expressed, no written protest has been received by us from any person entitled to speak upon the subject. But although we have had no silly letter sent to us in this case, a wise and temperate remonstrance has been made, and we feel fairly called upon to deal with the explanations that have been offered. And let it be understood that we have received "explana-"tions" only—not contradictions. Indeed, we were not open to mere contradiction; inasmuch as, while our general charges were based upon "complaints" which had been made to us by others, the particular circumstances to which we referred were witnessed with our own eyes. Passing by, for the moment, our general reflections upon the department, let us now glance at the several objects respecting which we made complaint.

In the first place, with regard to the covering in of the space between the storehouse and the forge at Sheerness Yard, a very weighty allegation is made, viz., that this objectionable proceeding was resorted to under the pressure of anticipated necessities during the Russian war. It is not denied that in an architectural sense the proceeding was a most objectionable and offensive one; but it is said, that when the Russian war broke out, and our fleets were sent into the Baltic, the want of means for repairing our steam-ships at Sheerness was so strongly felt, and the yard offered so little ground to work upon, that the conversion of the space in question into a boiler shop could scarcely be avoided, and Sir James Graham and his colleagues therefore unhesitatingly authorised it. There is unquestionably much force in this statement; and although we still fear the step was taken with less regard than might have been shown to æsthetic principles, we very cheerfully publish the explanation. As to the jetty which now stands out black in front of the dockyard, and which was the second thing mentioned by us with disapprobation, we are assured that the existence of some structure of the kind was an absolute necessity. The last thing to be noticed is the tramway laid down for the boiler carriages to run upon. The bad state of portions of this road is fully admitted—so fully that the executive officers at Sheerness have been blamed for it by their superiors. It is represented, however, that the method of constructing tramroads of wood blocks in the manner explained in our former article has been resorted to because of the rapidity with which granite roads wear and break up near the joints, and also because in the construction of the wooden roads much timber which would otherwise be sold as waste can be turned to account. It is further said that a road formed of wooden blocks placed on end in iron frames, and bedded on a basement of concrete, has answered the purpose very well in places where sufficient time has been allowed for the proper consolidation of the concrete. We must also remark that the plan of transporting and storing boilers which we attributed to the chief engineer of Sheerness dockyard is claimed by the Department of Works at Somerset House, although the Directors of that department bear the highest testimony to the zeal and ability with which this and many other plans for saving time, labour, and expense have been carried out at Sheerness dockyard by Mr. Blaxland. So well, indeed, have the factory operations been conducted at that yard, that the establishment has been brought into a very high state of efficiency.

It will be observed, from what we have hitherto said, that, having no interests but those of truth and fairness to serve, we are not in the slightest degree disposed to do injustice to the Directors of the Admiralty New Works. Complaints from many quarters reached us, and we willingly gave voice to them; statements opposed to those complaints are now made to us, and we as willingly give them publicity. In consequence of what we have recently learnt we are in a position to say further that Colonel Greene, the Director of Works, and Mr. Scamp, the Deputy Director, have been neither dilatory nor supine in the performance of their arduous and responsible duties. It must not be forgotten that, although they are the heads of a Department, they have to perform their duties under the sanction of the Board of Admiralty, and have to submit to all the delays and obstructions which invariably occur under such circumstances. This fact goes a long way in explanation of the "complaints" which reached us, and which we thought it well to express. We now have, indeed, reason to believe that the Department has been actively conducted—that an enlightened regard to the altered circumstances of our dockyard establishments has been paid by Colonel Greene and Mr. Scamp—that the introduction of many great and real improvements have originated with them—and that numerous causes of complaint against them disappear when circumstances over which they had no control are properly understood.

There is one other point, upon which, as it had very much to do with the *tenor* of our former article, we cannot with justice be silent. It is, the alleged independence with which the Directors of Works are said to conduct their business. We have not a syllable to retract from that severe introductory paragraph with which we commenced our former article. It is a shameful thing for men to manage the affairs of the nation with an utter disregard of the nation's welfare. In heaven's name let us not fail to exclaim against that sleek and sleeping officialism which is so full of peril to us as a people. It must be fought against, wherever found, by every one of us who can manage to keep a little patriotism alive in him. But, as the thing itself is so base and ruinous, it must not be lightly imputed; and for this reason we accept the protest made against the passage which we quoted from the Report of the Committee on Dockyard Economy and Efficiency in our former article. We are asked to believe that Mr. Murray and his friends were as far from the truth on that point as they were on nearly every other. Why, it is inquired, should we—who have so strenuously protested against the constitution of that Committee, and shown its unfitness to deal with our great naval establishments—why should we esteem it competent to sit in judgment upon the New Works Department of the Admiralty? Is Admiral Smart, or Mr. Laws, or Mr. Murray, the man to pronounce opinions upon roads and buildings; or is that versatile genius whom Mr. Lindsay dug up somewhere equal to this as well as to so many other imposing tasks? Our reply is, the Committee was as little fit for this business as for any other; but that is no reason why they might not have gone right *by chance*; and we certainly never implied that they went right otherwise. The truth is, this question—whether Colonel Greene and Mr. Scamp have sufficiently consulted with the officers of the dockyards—is one which must at present remain open. They strongly assert that they have; others think they have not; who shall decide? All we can say is, we most sincerely trust that whether they have or have not in the past, they will leave no room for doubt upon the subject in the future.

THE NEW BRONZE COINAGE.

WITH regard to the expected issue of bronze coins from the Mint, we believe it may be taken for granted that some little delay will arise. In the first place the design has to be determined on—whether a public competition of engravers be invited or not; and in the next a considerable time must be allowed for the "getting up" of a sufficient number of dies to enable the work of coinage to go on on a large scale without chance of interruption. It is not too much to ask of the public that time be given for the maturing of the plans of those officials and others in whose charge the working out of the Government resolve with respect to the new coinage will be placed. The public will grant reasonable indulgence no doubt, but they will not like to have valuable time wasted; and whilst promising the Treasury and the Mint that it will not be expected of them to produce bricks without straw, it must be understood that they certainly will call down upon themselves popular opprobrium if, having money, material, and appliances, they do not use diligence in turning them to proper account. If the new coins make their appearance with the new year there may not be great reason for fault finding; but beyond that time there can, we think, be no rational excuse for delaying their publication.

It is whispered that the device for the reverse of the three denominations of coins is to be that of Britannia, scantily clad, seated uncomfortably on a ledge of rock, with shield and trident, as now seen on the effete copper tokens. If there be truth in this whispering we can only say that we are very sorry for it. Why not have something new? Is there such poverty of inventive skill among engravers and others that there is danger of getting something worse? Has no one in the kingdom talent enough to sketch out a design which should be at once symbolical of the ocean sovereignty of Great Britain and a fit impression for a coin? Alas for us if it be so! But it can scarcely be credited that a gentleman of so much taste as the present Chancellor of the Exchequer will quietly assume so discreditable a state of things, and thus allow King Charles II. to be the author, or at least the patron, of a design for the new coinage of Victoria! We put it to the right hon. gentleman to interpose the weight of his judgment and authority, and to prevent a

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national disgrace. The opportunity is a great one, and it ought not to be lightly treated. Probably, when the next new coinage—be it decimal or otherwise—issues from the Mint, we of this generation shall have passed away, and it behoves us to leave behind us proofs that we were not deficient of taste, skill, or public spirit.

It would not be amiss if—since the new pieces of mixed metal are to be much smaller than the old pieces of copper—their value were to be imprinted upon them; and this might be done *à la* shilling and sixpence, if no better design is to be employed. The simple wreath of oak and laurel surmounted by the crown, and enclosing respectively the words, "One Penny," "One Halfpenny," and "One Farthing," with the date 1860 below, would be a decided improvement upon the almost nude allegorical Britannia, than which, in short, nothing can be worse. We are urgent upon this matter, because in our columns a reformed coinage was originally advocated, and to some extent our credit is involved in its satisfactory consummation. Parliament is not sitting, unfortunately, or some member numismatically learned might ask the question—"What impressions are to be given to the new bronze coins?" The public would like to have it answered, and so should we.

THE WESTMINSTER CLOCK.

MR. LOSEBY'S able letter, which first appeared in this Magazine on August the 12th, has been made the occasion of a very instructive quarrel. On the appearance of Mr. Loseby's letter, Sir Charles Barry explained (in a letter published in our last number) that the heavy clock hands which Mr. Denison now condemns were made with his (Mr. D.'s) approbation, and that he alone is therefore responsible for them.

Those of us who knew Mr. Denison of old, and to whom his blatant style is painfully familiar, anticipated the sort of thing that would follow. On the 25th forth it came (in the *Times*), coarse and copious as ever:—"Our great archi-"tect's head has evidently been turned by his "unusual run of luck. Hitherto he has been "getting that pleasant little *solatium* which "architects do, on all his extravagances and "miscarriages at Westminster, while other peo-"ple have got the blame. Architecture, venti-"lation, clock-making, dial-making, bell-hang-"ing, it is all the same." Then off he goes with paragraph after paragraph, to show that Sir Charles Barry is a nepotist—an imposter—a liar—and a scheming scoundrel generally. Having settled these little points with vehemence, he goes more quietly to work, and tells us leisurely that from the time when he was first asked to take this business in hand until now, there has not been a single stage in it in which he has not been put to needless trouble, and the nation to needless expense, by Sir Charles Barry's carelessness and blundering. The design of the clock had to be altered to suit his walls; the clock-shaft was too wide one way and to narrow the other; the great bell could never have been got up at all if it had been made of the usual shape, though he himself fixed the weight, and therefore the size of it, in 1846; the clock was kept back for years because it has to stand over the only place where the bell could be got up by any contrivance; the clock-room was too dark to work in; the staircase is now in the only dark corner of the tower, and has to be kept lighted with gas, and has windows opening into the ventilating chimney, where charcoal is burnt while Parliament is sitting; "and so," says this careful gentleman, "I might go on with a number more "of obstructions, moral and physical, which I "have had the trouble of encountering and the "satisfaction of defeating." About a twentieth part of his epistle is occupied with his reply to Sir Charles Barry's letter, which reply is in the following words:—"To his statements that I "approved those hands as ultimately made by "him, and that I fixed them, or saw them be-"fore they were fixed, or had anything what-"ever to do with the fixing, I give the flattest "contradiction within the compass of the English "language."

The next day, Sir Charles Barry—passing by the rude abuse of his antagonist—comes forward with a quiet but crushing rejoinder in the shape of the following "declarations":—

"We, the undersigned, who have been employed in executing the work of the hands of the great clock of the New Palace at Westminster, do hereby declare that we have acted throughout under the directions of Mr. Denison in that work, and that after having submitted to that gentleman two pattern minute hands, exhibiting various modifications for lightening the weight, we succeeded in producing a hand which he said entirely met his wishes. He also said that he did not imagine that they could have been made so light in weight, and desired that the remaining three hands might be proceeded with, in accordance with it in all respects.

"THOMAS QUARM, Clerk of Works.
"JABEZ JAMES, Engineer and Contractor for the Hands, Broadwall.
"HENRY HART, Foreman to Mr. James."

"We, the undersigned, having this day witnessed the weighing of one of the minute hands of the great clock of the New Palace at Westminster, do hereby declare the weight of that hand, and its external appurtenance, the counterpoise, to be as follows:—

	Cwt.	qrs.	lbs.
Entire weight of hand and counterpoise	2	1	22
Weight of counterpoise beyond the axis of the arbor or spindle (deducted)	1	0	25
Net weight of the hand	1	0	25

"CHARLES BARRY.
"THOMAS QUARM, Clerk of Works.
"J. JAMES, Engineer and Contractor, Broadwall.
"HENRY HART, Foreman to Mr. James."

These, of course, bring out Mr. Denison again; but this time he certainly is not happy in his own defence. He begins by saying he has "a short but tolerably decisive answer to "give to Sir C. Barry and all his certificates "from the people who did the hand business "for him," and then wanders off into a long, rambling, and abusive letter of nearly the same length as his first, heaping up a number of disconnected and obscure statements, but confining his real defence (!) to these words:—"The long "and short of the matter is that, as usual, he "made every blunder that lay open to him, and "grossly deceived me into the bargain, by get-"ting my consent to a pattern lighter than the "one I had first condemned, and then secretly "altering it into one much heavier and in every "respect worse." After this he beats a retreat thus:—"If he has any more to say I shall not "be able to return his fire with the usual velo-"city, as I am going into the north to-day, "having already lost three weeks of the long "vacation." And with this, away goes this versatile gentleman—this lawyer, clock-maker, bell-hanger, house-decorator—this professor of all the fine arts and many of the coarse—away to hide himself, as well he may, among the mountains of the north for a season.

But before he goes, he gives the dismal bell of Westminster another stroke, telling us that several musicians of great eminence assure him that the new Big Ben is very superior in tone to the old one, which deviated from the pattern he had given. "One of them says he considers "it the finest bell in Europe." This, however, is a matter of musical opinion, which he does not feel competent to discuss himself; but after all that has been said to the contrary, "by per-"sons not much more competent," it is a fact which ought to be known. Surely we ought to congratulate ourselves on knowing that this gentleman is no longer in a position to vent his nonsense upon us with his "usual velocity." The only thing to be regretted is, that his bell is too big to be taken with him.

Sir Charles Barry's answer to this last effort of his foe is brief enough. Like ourselves, he is "at a loss to discover in Mr. Denison's letter "any 'decisive' or even intelligible reply" to his statements; but is glad to find that he no longer denies having ever seen or had anything to do with the minute hands, which he has now condemned as useless. He (Sir Charles) is content, therefore, to leave the matter as it now stands, and has no wish to intrude further, by making any remarks upon "the gratuitous and "unfounded assertions and insinuations" regarding himself.

On the 26th, Mr. Thomson Hankey, M.P., put a question in the *Times* which we should like to see answered properly. He asks by whose authority Mr. Denison was placed in a position of responsibility in this matter. "I "made the inquiry in the House of Commons," he says, "but I was not able to obtain any "satisfactory answer." He then says, we all know that £20,000 of public money have been spent on this clock. What we have got for our money we do not know, beyond having an ordinary clock of which, after several years, one face alone is made use of, and a bell of no ordinary sound, but better suited to be used for tolling on great solemn occasions than for the ordinary use of a clock-bell.

"But what I want to know is," he continues, "who authorised Mr. Denison to have anything to do with the business? Is Mr. Denison a professed clock-maker, or a sub-contractor who has undertaken the contract which we all understood to have been given to Mr. Dent? Or is he merely an amateur who has been consulted on the occasion by the Chief Commissioner of the Board of Works? If the latter, may we hope that his services may be speedily dispensed with, as I think that we should all feel more safe that the further arrangements connected with this very costly piece of mechanism were intrusted to the management of some professional clockmaker, such as Mr. Dent, who would be really made responsible if the work is found to be to any considerable extent a failure—a failure, at least, in obtaining such a clock and bells as the public have a right to expect for an expenditure of £20,000."

Mr. Denison, in reply, says, "I am superin-"tending this work because I was asked to do "so by the Duke of Somerset, on the recom-"mendation of the Astronomer Royal, in 1851, "and again by Lord Llanover for the bells in "1855, after one of his two predecessors had "tried in vain to get the business managed "otherwise, and the other had neglected it alto-"gether." This answer will do for the present. The question will have its effect, notwithstanding Mr. Denison's evasion.

THE GREAT VICTORIA BRIDGE OVER THE ST. LAWRENCE.*

THE present autumn will witness the completion of, perhaps, the greatest engineering work of our time: of that great bridge across the river St. Lawrence, of which the Britannia Bridge over the Menai Straits proves to have been but the precursor, as to Americans it will hereafter seem but as the shadow. The Canadians, as may well be conceived, are intensely excited at the prospect of finding their country distinguished by so great a work of science; and throughout the United States the completion of the Victoria Bridge is regarded as an important event in the history of that New World which, since its discovery, has been marked by such rapidity of progress.

It may not be uninteresting, at such a time, to

* Communicated.

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recal the circumstances under which this work was undertaken, and to record briefly the history of its construction. There are many, indeed, who will gaze with wonder on the lofty piers and the stupendous tubes of this structure, to whom its peculiar features may scarcely suggest themselves; yet the greatness of the conception of this design consists, in reality, less in the size and character of the structure itself than in the objects, political, commercial, and scientific, which it is capable of effecting.

The primary necessity of a new country is a road. The better the line of communication, the more certain the new country of success. The greatest boon, therefore, that could be conferred upon Canada was the construction of a railroad: and those who devised and carried out the project of the Grand Trunk Railway, connecting the different dependencies of the British crown in North America, and passing through the richest parts of both Upper and Lower Canada for a distance of 1,200 miles, must be regarded as great benefactors to the country.

Yet, grand as was the conception of the Canadian Railway, its original design was imperfect. It was not a road through the province alone which Canada required. It needed, imperatively, a facile communication between the north and south shores of the St. Lawrence—railway connexion, free from the inconveniences of transhipment with the United States, and, above all, direct communication with the sea-board of the Atlantic.

A very little consideration of the circumstances of the country will show the imperative character of these requirements. The broad and rapid river St. Lawrence, whilst during the summer months of the year it opens out the whole of Canada to the ocean, for the five winter months completely isolates the province. Canada, lying to the north of the river thus frozen up throughout its course, is itself commercially as well as physically congealed. During that protracted season no ships can leave or can reach Quebec. With the United States the communication is, in every sense, of the most frigid character. Up to a very recent period, even intercommunication between different localities of Canada itself was, during winter, maintained with difficulty. To sleigh for 180 miles, as from Quebec to Montreal, was a task attended with no little trouble and with very considerable cost. Of course the transport of goods was impossible. Commercial markets, therefore, were comparatively useless. In fact, the want of means of communication with the outer world, prevented by the frozen state of the great river boundary and highway of the province, deprived the Canadian of nearly one-half of his active existence.

To the Grand Trunk Railway a direct and uninterrupted communication between the north and south shores of the St. Lawrence was also of vital consequence. Inasmuch as a bridge across the St. Lawrence was the key to the whole province, so, in possession of that key, the Grand Trunk Railway would command the whole external intercourse of Canada; whilst, without it, it must remain a mere provincial line. The tide of immigration sets very much into Canada from and through the United States. The whole of that traffic so important to the Grand Trunk Railway would have been lost without the connecting link between Canada and the United States. In the winter season, also, the Grand Trunk Railway, kept open, despite snow and frost, by various arrangements and appliances, would command the trade of the province without having to contend with any steam-boat competition. To show, by one illustration, the importance of a bridge to the Grand Trunk Railway, it may be mentioned that the Canadian Government contribute the large sum of £50,000 a year to the Steam Ship Company, upon the condition of its opening and maintaining the best direct steam communication between Liverpool and Canada. In the summer months the route can be directed from Quebec; but in the winter that is impossible. Without crossing the St. Lawrence, therefore, the route for which this handsome subsidy is paid could not be maintained, and the Grand Trunk Railway Company and the Canadian community would alike sacrifice the advantages of direct communication between Canada and Europe.

These considerations naturally weighed with increased strength upon the Canadian people and the directors of the Grand Trunk Railway as that line approached completion. A bridge they saw that they must have; but the question was, could such a bridge be made?

"The rapid river ran deep and wide;"

and there were not a few who thought that to span it by a bridge would be little better than a temptation of Providence.

The difficulties, indeed, of crossing the St. Lawrence were far from inconsiderable. Its width, even at the most available point, is very formidable; its current is very rapid; its depth not insignificant. Besides this, the navigation of the river, not merely by steam-boats and other vessels, but by enormous timber rafts, had to be provided for; so that unusual elevation and unusual width between the piers were both required. There was another obstacle, more formidable—far more formidable—than all. In the winter season the river St. Lawrence presents a field of ice from three to five feet thick. Whilst it is thus frozen, the river rises sometimes as much as twenty feet above its summer level. This rise of water might be provided for; but how was accident to be avoided, at the annually-recurring period when "THE BREAKING UP OF THE ICE" exhibits, in North America, one of the most wonderful operations of nature on that continent?

This "breaking up of the ice" in North America, though welcomed as the harbinger of returning summer, is an event which carries with it no inconsiderable amount of apprehension to the mind of the Canadian. From the extreme thickness of the ice in the middle of the river, little or no effect is immediately produced upon it by the action of the sun. But the banks of the river, imbibing the heat, melt away the thinner portion of the ice which touches them, thereby depriving the main body of the support it receives from its contact with the land. Then, when a small line of blue water intervenes between the shore and the river ice, the ice begins to move, first slowly, then more rapidly, until the velocity and power of the current, rapidly increased by the melting of the snow, wrenches the ice upwards, and breaks and tears it into fragments, which, larger or smaller, go floating down the river in masses, bearing before them almost everything which they encounter.

Dismal tales are rife in Canada of the fatal disasters which have occurred to life and property by "the breaking up of the ice." The city of Montreal has especially suffered from these fatalities. Before now, the ice has burst into that city and been found sliding down its streets. It has broken into the second-floor windows of dwelling-houses after blocking up the front doors for weeks. It has forced down river terraces and spoilt public and private gardens. Large warehouses, erected without due protection on the banks of the river, have been pushed over by the great moving sheets of river ice, as if they were mere houses of cards. At sudden bends of the river, where the ice meets with obstruction, it piles itself sometimes into huge icebergs, from fifty to eighty feet in height. At length, when the river rises, these icebergs get again into its current, and go rolling and sweeping down the St. Lawrence, carrying danger and destruction all before them.

Could any bridge be devised to withstand these formidable difficulties? If possible, how was such a bridge to be constructed? The directors of the Grand Trunk Railway, to whom these questions were so vitally important, took a course which will probably be thought to redound greatly to their enterprise and sagacity: they determined to take the opinion of the most eminent engineer whose advice and counsel they could obtain.

The Britannia Bridge across the Menai Straits was opened in 1849, and it was not, therefore, unnatural that in 1852 the directors should look to Mr. Robert Stephenson as the engineer most competent to advise them. Mr. Stephenson considered the subject of so much interest and importance, that he determined to go out to Canada, personally, for the purpose of dealing with it. He accordingly repaired there at the end of the summer of 1853, and, after examining into the facts, made a public declaration of his opinion, that a bridge across the St. Lawrence was practicable. On the 2nd of May following, Mr. Stephenson addressed to the Grand Trunk Railway directors a report, in which he considered the whole question in three branches: first, as to the description of bridge best calculated to prove efficient and permanent; second, as to the proper site; and, thirdly, as to the necessity for such a structure. Upon the first point he did not hesitate at once to recommend the adoption of a tubular bridge, as the description of bridge best fitted for a permanent, safe, and substantial structure in such a situation; on the second point he was not a little influenced by considerations affecting the flow of the river and "those almost irresistible forces" consequent upon the breaking up of the ice in spring.

As Mr. Stephenson's view of the nature of these forces, and the best mode of encountering them, has not yet, that we are aware of, received publicity, it may be interesting to place them upon record—especially as we are enabled to do so *with authority*. Mr. Stephenson, on his arrival in Canada, met with numerous alarmists, who could graphically describe to him the effect of the ice, but he met with no one who had in any way measured or calculated the amount of its pressure. In considering the question whether a bridge could be constructed to withstand that pressure, it appeared to Mr. Stephenson to be of primary importance to ascertain really and precisely what that pressure was. This was a question of calculation; though, in the absence of any data, the difficulty was how to calculate it. And here, before the reader proceeds further, he may, perhaps, not without advantage, pause for a moment to ponder on the way to solve the problem—what is the amount of the pressure of ice four or five feet thick in a running stream of a certain inclination, velocity, and breadth?

This problem puzzled Mr. Stephenson himself at first; but it was not long before he hit on an expedient. He first got at the inclination of the river; next at its velocity. He then assumed that the ice upon that river was what they told him it usually was, from four to five feet thick. He then inquired into the condition of the river, and he found that, about nine miles above Montreal, there was a fall called the Fall of Lachine, which, of course, separated the body of ice above the fall from the body of ice below it. Taking these data, he calculated what would be the pressure of nine miles of ice, from four to five feet thick, lying on a plane of a given inclination, and pressing against the piers of a bridge across the channel. The result of that calculation in figures it would be unnecessary, even if it were possible, to state; but, whatever were the figures, they enabled Mr. Stephenson at once to realise one all-important fact. He arrived at the conclusion that "the almost irresistible force" of this mass of ice would crush or sweep away any ordinary bridge, and that all the suggestions previously made for encountering the difficulty were only likely to result in disaster if carried into effect.

For up to the period of Mr. Stephenson's Report, great difference of opinion existed in Canada and elsewhere as to the probable effect of the ice pressure. One party held that no bridge whatever could stand against it; another, whilst admitting the difficulty to be formidable, thought timber casings or fenders, such as those in use on the small rivers of Norway and elsewhere, would be an efficient protection for the piers. The proposal most forcibly impressed on Mr. Stephenson was to protect his piers by what is called a "crib-work;" that is to say, by large masses of timber in front of the piers, crossed and weighted, and as

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thick or thicker than the ice itself. It was evident, from the first, that this extensive crib-work must be an additional obstacle and impediment to the free navigation of the river, and to the passage of the ice. But, beyond this, Mr. Stephenson's calculations convinced him that such a work would be entirely inadequate to protect such a structure as he contemplated, in such a river as the river St. Lawrence; and that, even if the crib-work stood, it would be subject to such abrasion and wear and tear, from its conflicts with the ice, that it would require to be reinstated at least every two or three years. It was more than doubtful to his mind if such an arrangement would be capable of resisting the ice at all; and if it did not, the capital of the company would be wasted. Mr. Stephenson, therefore, at once determined that such a work was undesirable; and that such enormous stakes as those at issue could not be left dependent upon the uncertainty of such an expedient.

The abstract methods he had taken to ascertain if any bridge would withstand the almost irresistible pressure of the ice, had not alone convinced Mr. Stephenson that no such projects would avail as those proposed in Canada. They had equally satisfied his mind as to the amount of resistance requisite to encounter the pressure against which it was needful to provide. Knowing what timber would not resist, he equally knew what resistance could be afforded by substantial masonry. "Cribs" he felt were useless, but there were methods by which the pressure could be resisted independently of "cribs." Mr. Stephenson decided on the adoption of stone piers, to carry the tubes at wide intervals, each pier having, on the side opposed to the course of the stream, large cut-waters of solid stone work, inclined against the current, up which, as it were, the ice would creep, and break itself to pieces by its own weight and pressure. He arranged that these wedge-shaped cut-waters should present angles to the ice sufficient to separate and fracture it as it rose up upon the piers, but at the same time so obtuse as not to be liable themselves to fracture. These piers, therefore, were devised to answer the double purpose of piers and ice-breakers. They exhibit, as now constructed, every indication of massiveness and power to resist pressure as well as of stability to support the superstructure. Experience, indeed, has proved the piers suited for all the purposes for which they were designed. During the four years the structure has been in progress, it has entirely fulfilled all the conditions its originator anticipated; and it has withstood, in the most satisfactory manner, the most violent pressures which have followed the break-up of the ice.

Whilst the piers of this bridge are thus peculiar in their design, in order to meet the peculiar circumstances of the country and the climate of Canada, the superstructure, which creates in America so much surprise, is an elongated repetition only of the design for the Britannia Bridge. The Victoria Bridge is indeed remarkable for its extreme length, but its several tubes are not so long as those of the Britannia Bridge, and are only otherwise distinguishable inasmuch as that they are the longest tubes yet constructed without the adaptation of the cellular principle. It deserves notice, however, that these tubes, in all their details, were designed, plate by plate and rivet by rivet, in the office of Mr. Stephenson, and were calculated for every strength and strain, and prepared and arranged in all their details under the sole superintendence and supervision of his relative, Mr. George Robert Stephenson. With such nicety were all the arrangements respecting these plates conducted in this country, that, under the directions of that gentleman, every plate and piece of iron was punched in England before it was sent out to Canada; and elaborate and detailed drawings and instructions were sent by the same hand to show the method of connexion. On the arrival, therefore, of each separate cargo of iron in Canada, little remained to those upon the spot but to fasten together the various pieces, and place them in their order and position as directed.

So entirely, indeed, have the details respecting the tubes been conducted on this side, that it has not only devolved on Mr. G. R. Stephenson to examine the quality of the iron at the iron-works, but to superintend the construction of the plates at the manufactory, and to issue instructions for putting the pieces together. Upon him has devolved the duty of seeing to the shipment of each tube as it was completed, and of signing the certificates for payments, not alone to the contractors but also to the resident engineer and other officials in Canada, who were employed and paid under Mr. Robert Stephenson's directions. It is most gratifying that, from first to last, the design has been carried out harmoniously and efficiently by all concerned. Great credit is due to Alex. M. Ross, who was appointed the resident engineer to superintend the bridge works in Canada, and who has especially devoted himself to the erection of the masonry; to Mr. Hodges, who, from the commencement, has most efficiently and honourably represented Messrs. Peto, Betts, and Brassey, the contractors, and on whom has devolved the principal responsibility in the execution of the works; as well as to Mr. Stockman, who, in the early part of the present year, went to Canada, accompanied by Mr. S. P. Bidder, to make a full inspection and detailed report upon the works—a duty which was performed in a manner eminently calculated to satisfy the minds of the engineers and of the public.

It is not the object of the present preliminary paper to enter into the fuller statement, which will hereafter be given, of the dimensions of the bridge, of its quantities, and of the various details connected with its construction. The present object is rather to exhibit the theory upon which it was commenced and carried forward. One remark, therefore, in conclusion, is alone necessary. Canada owes this bridge to one mind—the mind of Robert Stephenson. Had that eminent engineer expressed the smallest doubt or apprehension, the directors of the Grand Trunk Railway would have shrunk from involving their company in an expenditure of a million and a half of money to carry a bridge across the St. Lawrence. Until Mr. Stephenson had satisfied the Grand Trunk Company, they would not entertain the idea of constructing such a bridge; and, unquestionably, Mr. Stephenson would never have satisfied the company unless he had thoroughly satisfied himself. It was the reliance of the company on Mr. Stephenson's experience and professional reputation that induced them to commence the bridge; and having pledged that experience and reputation, Mr. Stephenson, who would have been responsible for failure, is entitled to the full meed of honour and of fame which must hereafter attach to the successful execution of so great a work. He has indelibly inscribed his name on the structure which resists the ice of the St. Lawrence.

THE ENFIELD RIFLE, PATTERN 1853.

THE Enfield rifle musket of pattern 1853 has not been exactly described as yet, although several high authorities have attempted the task of explaining its peculiarities. In as few words as is consistent with clearness we shall endeavour to supply the deficiency. The *stock* of this deadly weapon is of walnut wood, imported principally from Italy. Before being manufactured, each particular piece of it is subjected to careful examination by Government Inspectors, who place distinctive marks upon all they accept; consequently, if a stock exhibit defects at a later stage the Inspector who passed it is made responsible for his error. Walnut wood is used because it is at once light, tough, and capable of withstanding great changes of climate. The *barrel* is of wrought charcoal-iron of the best quality, and is usually supplied by Marshall and Co. of Sheffield. It is required to be prepared in the most scrupulously careful manner. Each barrel must be perfectly solid and without even the appearance of a seam. If a speck be discovered even after the finishing touch has been given, the barrel is condemned. They are all subjected to two tests during the progress of manufacture, once in an early stage, and again when nearly completed, and in each case with charges of gunpowder three times greater than that required for the longest range.

The length of the barrel is 39 inches, the outward diameter at the muzzle ¾ inch, and it tapers towards the breech, where, of course, more strength to resist concussion is necessary. As may be supposed, the *bore* has to be an object of especial care. It must not have upon it the slightest scratch, for if it had, the saltpetre of the gunpowder used subsequently would adhere—more especially in rapid firing—and make the cavity larger. The diameter of the bore is rather more than ½ an inch, but less than ⅝th, in fact, by the micrometer—decimal, ·577, and this must be exact, for the rejecting gauge is only decimal ·580, thus allowing a latitude to the worker of less than the 3000th part of an inch. Of the grooves or rifles, of which there are three in each barrel, it may be said that their accuracy of finish is of equal importance with that of the boring. The depth of these grooves at the muzzles does not exceed the 500th part of an inch, whilst the width is ⅛ths. The twist or pitch is equal to one half turn in the length of the barrel. The breech end of the latter is chambered to allow for the expansion of the bullet. The bullet, as is perhaps known, is conically shaped, and has its back end recessed for the insertion of a box-wood plug. This plug, driven forward at the first shock of the explosion of the gunpowder, expands the lead until it fills the grooves at the breech. In passing towards the muzzle the bullet is subjected to the compression of the shallower portion of the groove, and hence the force with which it wings its way as a messenger of death! The bayonet is a fitment of the rifle, and in the hands of a British soldier is a formidable instrument, as his enemy has ere now found. The blade of the bayonet in this case is made of the very best cast-steel, finely tempered, and welded to a socket of wrought iron, which is bored out to the precise size of the outer diameter of the muzzle, which therefore it fits. A little contrivance called a locking ring enables one to ship and unship the bayonet easily, but makes it difficult for a foe to do so. It is twisted, as it were, over the *fore sight* in being fixed, and has to be twisted back in a peculiar way when removed. The *back sight* is a simple and excellent contrivance. It is composed of a leaf, which works on a joint attached to the "bed," and on this a little slide can be worked at pleasure according to the gauge required. This slide is graduated and figured for regular service, commencing at 200 yards and advancing to 1,000. By raising this slide, therefore, to any figures you please, and bringing a little V-shaped nick in the slide to cut the line of the *fore sight*, a steady-handed and quick-sighted rifleman may assure a certain range. The *back-sight* when all its parts are complete, is soldered to the barrel. The *lock* is a most ingenious and important part of the killing machine, and consists of a number of parts—first, the *lock plate*: this is of the best wrought iron, case-hardened. Fitted to this, with much nicety, is the *tumbler*: this latter is of the best cast steel, hardened and tempered to a spring temper. Then there is the *sear* also of steel, and tempered *à la* tumbler. The nose of this sear is of a wedge form, and fits into a notch cut in the tumbler. When the rifle is at half-cock, the trigger may be pulled with any amount of force, and the sear cannot be disengaged nor the rifle be discharged. But there is another notch in the tumbler, and when the sear is made to fall into that by placing the rifle at full cock, a pressure of 13 lbs. on the trigger brings down the hammer upon the nipple. Over the tumbler and sear is placed a *bridle*, of wrought-iron, case-hardened, and firmly attached with two steel screws. This is properly named, for it leaves the lock, free for action, or bridles it immoveably.

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The swivel or link connects the main spring with the tumbler.

The main spring of tempered steel is of much consequence, and has to be most carefully prepared. It is brought to a standard gauge, and is tested in every way for strength and "set." This latter is effected by compressing and expanding it in the most severe manner, and making it "give" finally at a pressure of 14 lbs. The sear spring is used for putting a pressure on the sear, and keeping it up to its work with the tumbler. The hammer is a very peculiarly-shaped piece of work, with a square mortise fitting the squares of the tumbler.

If the hammer was not well fitted its constant action in falling upon the nipple would cause it soon to get out of order. The nose of the hammer is cupped large enough to fall clear of the outward diameter of the percussion cap. The cup or recess must be made extremely smooth and clean, because if at all rough there would inevitably take place within a deposit of saltpetre, and this in action would constantly be augmented until at last it fouled and stopped up the communication hole in the nipple. After the hammer is driven on to its place it is secured by a screw, which is furnished with a head large enough to cover all the jointing. The hammer and screw are both made of case-hardened iron. The nipple is of cast steel, first hardened and then let down to a blue colour. The material of which it is composed must be of the very best quality, or they would, from the treatment to which they are exposed, be continually breaking off. The nipple is attached by means of a very finely-pitched thread—20 to the inch, indeed; it is screwed down to its "shoulder" on the cone seating of the barrel. Perhaps the term "cone" would be a more appropriate name for the nipple. It is conical in outward form, whilst the inside comprises two distinct cones tapering either way from the centre or communication passage. This passage is very small, little larger, in fact, than an ordinary pin would fill. The nipple is coned from the top side to allow the detonating powder, when the cap is exploded, to have free access to the communication passage, and from this it is coned away suddenly to give facility for the flame, after the explosion of the cap, to spread over the the charge, and thereby ensure its explosion.

As to the ramrod, it is made of steel very carefully hardened and tempered. It is considerably larger at one end than the other, and has a mortise cut through the stoutest end for the purpose of attaching to it a wiper for "swabbing" out the barrel. The other end has a screw cut upon it for the purpose of fastening thereto a small corkscrew-like mechanical contrivance for drawing the charge if required. There is a small piece of iron let into the stock as a bearing to the end of the ramrod, and likewise to prevent injury to the wood if dropped too heavily into its place. This is the *rod-stop*. There is also connected with this matter a *rod spring*, and this exerts such an amount of pressure on the ramrod as to prevent its falling out when hurriedly used in active service.

The most important component parts of the Enfield rifle have now been spoken of, and some description of what is technically known as the "furniture" branch of its manufacture may next be given. In the first place, then, we have the "nose cap," this is of brass and fixed to the nose or end of the stock by means of a screw. It is intended to give a firmer bearing to the barrel, and to prevent the fracturing of the wood upon which it rests. Then we have the bands which slip over the barrel and stock, and confine the two together. These are each tightened up by a screw; there are three of them, the upper, middle, and lower. They are of wrought-iron, and their forging is a very important piece of work for the smith. They have to be welded up solid, and as they are all afterwards machined, must be forged to a gauge. It requires a very expert fitter to finish these strange-shaped hoops. When finished they are brought down to the blue stage, and then affixed in their respective places. To the upper band is attached a swivel or bracket for the convenience of the rifleman in slinging the weapon. This, too, is of wrought-iron blued. The trigger is of wrought-iron case-hardened. It is let into what is called the trigger-plate, which is of brass, and a screw passing through them both forms a joint. The trigger is brought into contact with the tang of the sear by the application of a pressure equal to 13 lbs. This releases the tumbler and lets off the hammer on to the cap. To protect the trigger there is contrived a guard made of brass, and affixed over all to the stock by means of two screws and a small round pin. Next we have the butt or heel-piece, also of brass, and fastened by means of three screws to the butt-end of the stock. We must not forget, either, two little side-cups of brass, which are sunk into the stock on the side opposite to the lock, and which afford substantial bearing for the screw-heads which draw the lock into its place and hold it there. These complete the list of components and furniture of the rifle musket of 1853; but it remains to us now to sum up all the items in one catalogue with their technical names. Few, on a cursory glance at the light, polished, handsome weapon which is now coming into such general use among amateur and regular soldiers, would believe that so many as sixty accurately moulded and fitted pieces of steel, brass, wood, and iron went to make it complete, yet such is the fact, and here are the names of these pieces:—The stock, the barrel, the bayonet, breech-pin, locking ring, locking ring screw, ramrod, rod stop, rod spring, rod spring pin, two side cups, nose cap, nose cap screw, two side screws, tang screw, trigger, trigger plate, guard plate, guard pin, three guard screws, butt plate, two butt screws, guard swivel, swivel screw, two lock nuts, upper band, middle band, lower band, three band screws, nipple or cone, tumbler screw, sear screw, sear spring screw, bridle screw, two sight screws, locking ring stop, sight bed, sight leaf, sight spring, sight slide, sight cap, hammer, lock plate, tumbler, sear, sear spring, swivel, bridle, band swivel, and main spring!

When it is known, too, that from the excessive care of the workpeople at the Enfield Small-arms Factory, and the admirable precision with which the various and beautiful machines in use there work, these pieces are all counterparts of each other, and that the components of a hundred rifles may, after being indiscriminately mixed, be taken up and put together without difficulty or delay, it will be admitted that their manufacture has reached something like perfection in England. It is our purpose, however, to endeavour ere long to convey a more exact description of the mechanical appliances in use at Enfield than has been afforded to the public, convinced that our labour in the task will be appreciated.

"THE NAVIES OF THE WORLD."

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Perhaps I may be allowed to say a few words in reply to the observations contained in your last number, relative to my work on the "Navies of the World."

The reviewer commences by suggesting that the book is little more than a compilation of the contents of the parliamentary returns which appeared at the beginning of the present year; whereas the materials had been in progress of collection for many months, not to say years, previously, and the greater part of the book was actually in type long before any of the parliamentary papers were issued. From them I selected a few tables likely to be useful, throwing them for the most part, however, into the Appendix. But had I obtained earlier access to these documents, they would have been of but little service in the main object I had in view, that of enlightening the English public as to the real strength of the French navy—a topic upon which hardly anything was accurately known, until I printed the only reliable catalogue of French men-of-war now in existence, showing at the same time the power of each individual ship, the date when her keel was laid down, when she was launched, and, in the case of steamers, the horse-power of her engines, and the name, in most instances, of the engineer by whom they were constructed. When it is remembered that no navy list is allowed to be published in France, that the very meagre accounts to be obtained here and there through private channels were often grossly incorrect, and the information, from whatever quarter procured, had to be repeatedly checked in order that the results should be of any value at all, it seems scarcely fair that one who has toiled as I have done with so important an object in view, and with little prospect of personal emolument, should be classed with the mere literary hack who "gets up" a volume out of a blue-book at the bidding of a publisher. No one, who did not accompany me in all my wanderings, extending as they did over many thousand miles—no one unacquainted with the heavy outlay in a variety of ways, can form any idea of the drudgery I underwent in order to ensure the utmost attainable accuracy, nor of the cost at which it was procured. I am scarcely surprised, therefore, that your critic should affect to treat the matter so lightly; but why should he—speaking of an individual with whose previous studies and pursuits he must necessarily be altogether unacquainted—say, "considering who he is, and how very little *he could be expected to know* of the world's navies, he has really done his work astonishingly well."

The subject happens to be one with which I have been familiar for nearly five-and-twenty years, not only by study and research, but, to a great extent, by actual observation; and I believe I have in my possession more voluminous documents relating thereto than would, perhaps, be found in the possession of any other private person. Practically, too, though only in the humble capacity of a yachtsman, I have had some slight experience in shipbuilding, and in the construction of nine vessels, varying from ten to two hundred and odd tons each, have successfully accomplished in every instance the particular object I had in view, a feat not invariably achieved by our professional shipbuilders, even when aided by the omniscience and boundless resources of the Admiralty. It is, therefore, just possible even for an officer in a rifle regiment—presumptuous though it may seem—to know something of navies and of the true but obscure principles of shipbuilding.

Your reviewer having tested my pages, and fortunately not having been able to detect a blunder "in the detailed lists of our own navy"—nevertheless charges me with errors—"errors into which *none but a purely amateur writer* could have fallen;" but all he can allege against my accuracy is a statement with reference to the draught of water of some of our larger screw ships, respecting which he says that "no naval man need be told that these are most absurd statements." In justification I may observe that he has, unluckily for his own acumen, pitched upon the *only* assertion in the whole volume for which I am indebted to an English naval officer.

While the proof sheets were passing through the press, my attention was called to an article by an officer in the navy in the October number of the *United Service Magazine*,* giving the draught of our steam men-of-war. I admit that I was somewhat surprised to find them stated as they there appear, but relying upon the high character of the periodical, and the information of the writer, I quoted his words: "The following abstract," says he, "will be found pretty accurate in showing the draught of water in screw ships:—

			Feet.
Screw	3-deckers, as	Duke of Wellington	34 to 36
,,	2 ,,	as Renown	32 to 35
,,	,,	as Brunswick	28 to 32
,,	blockships, as	Blenheim	21 to 23
,,	frigates, as	Orlando	30 to 32
,,	,,	as Euryalus	23 to 26
,,	,,	as Arrogant	19 to 22
,,	,,	as Dauntless	17 to 20
,,	corvettes, as	Highflyer	17 to 20"

* Page 246.

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The above is my authority—one of the very few, I must admit, which I omitted to verify. The alleged error, if error it should be, is not mine, then, but that of an experienced writer on naval subjects.

The incident is in one respect satisfactory, since it shows that your reviewer, with all his practised powers brought to bear upon my book, was notable, out of the many thousand separate facts it contains, to pick out one upon which a reasonable allegation of carelessness or inaccuracy could be based.

For all that, he concludes with a somewhat disparaging remark, observing that the compilation "is useful and timely, that many may read it with profit while no one must believe *all* that it says."

I must now apologise for obtruding myself at this length upon your space. I should not have done so but that, out of two-and-thirty different critiques forwarded to me, yours is the only one which disputes with me that absolute accuracy which I have striven so earnestly to attain, I believe, not altogether unsuccessfully.

I am, Gentlemen,
Your obedient servant,
THE AUTHOR OF "THE NAVIES OF THE WORLD."

United University Club, 30th Aug., 1859.

[By the tone of the above letter Mr. Busk invites us to a species of dispute for which we have no affection. Instead of answering him angrily we will take the trouble to go carefully over his remarks, and notice such of them as seem to need comment. Mr. Busk begins by saying:—"The reviewer commences by suggesting that the book is *little more* than a compilation of the contents of the parliamentary returns," &c. This is an error. We suggested that the parliamentary returns probably gave rise to the volume; but we never implied that the volume contained "little more" than they. The later portions of our article gave Mr. Busk full credit for a large amount of original matter. We are next told that "the greater part of the book was actually in type long before any of the parliamentary papers were issued." Now, while we are quite willing to accept Mr. Busk's word, we are not willing to let the matter drop without showing some few of the grounds we had for our conclusion. The first parliamentary return of the present year upon this subject was published in February, and appeared in our own Magazine on the 4th of March. At this time, then, Mr. Busk tells us "the greater part of the book was actually in type." Now, we are prepared to show that in *every chapter* there are passages which would lead to a contrary belief. The very first sentence of the *first* chapter speaks of "the secret league into which it is generally believed he [the Emperor Napoleon] has thought proper to enter with Russia." Did not the rumour of the "secret league" first get bruited during the late Italian war? and did that war begin long before February? In the *second* chapter we are told that the "Conversations Lexicon" article had "undoubtedly produced a great sensation throughout Europe," and the chapter consists *solely* of a review of that production. The article was not printed in the *Times* or heard of in England until January; could the European sensation created by it, then, have come to pass, and been written and printed about long before February? In the *third* chapter Mr. Busk quotes copiously from the speech made by Sir John Pakington on the 25th of February last; and gives several extracts from papers published in the following April; could this have been done long before February? The *fourth* chapter relates almost exclusively to foreign navies, and need not, therefore, bear materially upon the present argument; but even in this we find a statement of a personal matter, which was not made public till December last; and could not, therefore, have been in type long before February. The *fifth* chapter contains information condensed from Mr. Isherwood's "Engineering Precedents for Steam Machinery," as quoted in this Magazine on the 18th of February, the volume itself having only appeared during that month; could this have been in type long before February? In his *sixth* chapter we again meet with copious quotations from the parliamentary papers of April last; could these have been in type long before February? The *seventh* chapter begins by again quoting Sir John Pakington's speech of the 25th of February, and then enters upon an elaborate discussion of the Royal Commissioners' Report on Manning the Navy, which was not published till the 19th of February; could all this have been in type long before February? The *eighth* chapter contains quotations from the speech of the Secretary-at-War on the 4th of March last, and others from Sir William Armstrong's speech of the 10th of May; could these have been in type long before February? In the *ninth* chapter we have a long quotation from the *Saturday Review* of the 12th of March last, and an abstract of a parliamentary paper of the 4th of April; could these have been in type long before February? The *tenth* chapter is the last, and is headed "Conclusion;" was this in type long before February? Surely, after all this, we may be excused for not having of ourselves discovered that "the greater part of the book" was written long ago. Mr. Busk next mentions at some length the labours he has performed in acquiring intelligence in reference to the French navy. As we filled nearly a column and a half of our last Number with his remarks on this subject, and as we took pains to state that "he had amassed an unexampled amount of information relative to the French navies and naval ports," we scarcely understand why he has requested us to give insertion to another long statement upon the subject. Mr. Busk next affects to consider our remark about the little he could be expected to know of the world's navies an improper one. This is all very well in its way, but we really must insist upon the perfect right we had to make the remark, especially when it was only made with the view of reflecting greater credit upon him. Does Mr. Busk wish us to understand that barristers generally are well up in naval matters, and must be expected to know much of the world's navies? We think not; we rather suspect he wished to make known what he had done in the way of amateur shipbuilding, and chose this means of telling us. It is mere nonsense to talk about the "presumption" of a rifleman knowing something of navies and of the principles of shipbuilding. We used no such language. We must further tell Mr. Busk he is quite mistaken in supposing that we "tested" his pages, and were "not able out of the many thousand facts it contains, to pick out one upon which a reasonable allegation of carelessness or inaccuracy could be based." As Mr. Busk challenges us to speak more fully on this point, we will state what we did do by way of preparation for noticing his work. We first glanced through it in a general way for about half an-hour, which was quite sufficient to show us that it was in the main a mere compilation, and that we had met with a very large portion of it before in various forms, and had, indeed, published much of it in our own columns. We also observed that the subjects discussed in it were very numerous, and were in many instances dealt with superficially. We then turned to the classified lists of our own navy, and found that on the whole they had been gone over carefully; although not so as altogether to avoid errors, for both the London and the Lion appear in his list of *sailing* ships. It was while looking over these lists that our eye fell upon the extraordinary statement respecting the draughts of water of our larger ships. Mr. Busk now accounts for this statement by saying he got it from the *United Service Magazine*, and sneers at our acumen because a naval man first made it. But it really does not matter where Mr. Busk got it from. That he obtained it in the manner he did only confirms our worst fear, viz, that he has picked up some few of his facts from sources which turn out not to be reliable, not knowing himself whether they were accurate or otherwise. In his last sentence Mr. Busk still asks to be considered absolutely accurate; and seems to think that line-of-battle-ships *ought* to draw 36 feet of water because one-and-thirty critics do not know to the contrary! We really cannot oblige him; and as for the one-and-thirty critics—what on earth do critics know of such things? If Mr. Busk had said a *schooner* drew 36 feet of water he would have escaped the general run of critics with equal impunity. In conclusion, let us say we think the author might fairly have read our article contentedly. We endeavoured to do full justice to his labours; and when we gave him credit for his arduous and successful inquiries into the condition of foreign navies—particularly the French—and stated that his detailed lists of our own navy are also very copious, complete, and accurate, we set a higher value upon his volume than a score of such letters as the above could secure for it. If he makes a wise use of our remarks he will get more good out of them than even thirty-one indiscriminate eulogies will yield.—EDS. *M. M.*]

THE ATLANTIC CABLE.

THE following report of Mr. F. C. Webb, C. E., has just been made to the Chairman and Directors of the Atlantic Telegraph Company:—

"Valencia, Aug. 10. Gentlemen,—According to your request I made from Valencia a careful examination of the electrical state of the Atlantic cable. I made some tests for comparison on the various pieces of Atlantic cable in Messrs. Glass's premises at Greenwich during July 31 and August 1. I arrived here on the 4th inst., and, assisted by Mr. Collett, made experiments during the 5th, 6th, 8th, and 9th inst. I find the lowest resistance shown to be 278 statute miles. I find it is possible to increase this resistance up to 589 miles by sending a copper current for some time from six 12-plate Daniel's batteries. By experiments I have made on various kinds of constructed faults I find that a fault which could be thus oxidized so as to give (by reversal of the current) a difference of resistance equal to the difference obtainable on the cable—viz., 311 miles, must give a *minimum* resistance of about 16 miles. When the fault is large, and thus gives little resistance, no great change can be obtained by reversing the battery: and, indeed, it is evident that when the connection between the line and earth is increased beyond a certain extent of surface no difference in the resistance of the circuit can be obtained by reversing the battery. When the fault is very minute it can be almost perfectly sealed up by a copper current, but the resistance will still be very great, even with a zinc current. My experiments show that a fault of about 16 miles minimum resistance can be varied with certainty by reversal of the battery to the same degree as the fault in the cable, and that if the fault gives less resistance than 16 miles it cannot be varied to that extent, while, if it gives more resistance, the variation cannot be produced with the same certainty, nor quite to the same degree. Taking, therefore, the resistance of the fault and cable beyond the fault to be equal to 15 miles, this would bring the fault to about 263 statute miles from Valencia. As I have no information of the return current due to different lengths of the Atlantic cable, which might have been observed and tabulated during the paying out of the cable, it is impossible to check the resistance tests accurately by the observed return current. Comparing it, however, with the return current on the Cagliari and Malta and Corfu cables, and making, roughly, allowance for the increased size of the gutta-percha in the Atlantic cable, I find it to be about what is due to the supposed distance of the fault. I also made experiments on the return current with a wire leading to earth from the cable, and by placing resistance in circuit in this wire I could represent a fault close at hand and of varying resistance.

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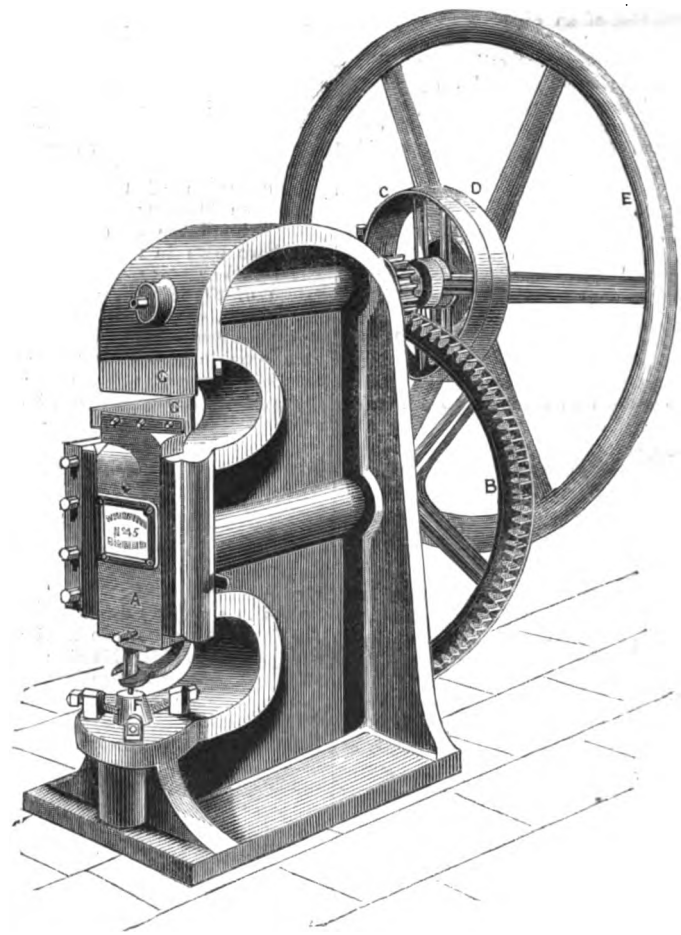
I found that in such an arrangement, when the artificial fault gave a resistance of 300 miles, the return current was only reduced about 22 per cent. If the real fault, therefore, was close at hand, the return current of the whole length of perfect cable beyond the fault would be only reduced about 22 per cent. also. I am of opinion that the observed return current is much less than 78 per cent. of the return current due to the whole cable, as it would be if the fault were close at hand and of a resistance of about 300 miles, and that it coincides, as nearly as I can judge, with that due to the length shown by the resistance. Again, when the artificial fault was made to represent a resistance of 260 miles and then increased to 580 the return current only increased about 17 per cent., whereas when the real fault is increased to the same amount of resistance (by sending a copper current for some time) the return current increases about 80 per cent. This shows also that the return current is more influenced by the partial healing of the fault than it would be if the fault was a small one near at hand, and consequently tends also to confirm the supposition that the fault is distant, and offers, when at its *minimum*, little resistance. I am of opinion, therefore, that a serious fault exists about 263 statute miles from Valencia, measured along the cable, and that the cable between that spot and this shore is comparatively perfect. No tests from here can now decide whether the cable is mechanically severed, since all attempts to detect the reception of the most intense currents from the opposite shore have long since proved fruitless. Still, from the various circumstances attendant on the decline of the insulation, there is every reason to believe that the continuity both of the cable and the conductor is perfect. Whether any other faults exist beyond the one alluded to it is impossible to ascertain by tests from Valencia. The fact that the signals received at Valencia were always better than those received at Newfoundland proves, undoubtedly, that the worst insulation has always been near Valencia; and, therefore, it seems probable that if the fault which exists on this coast, and which, very likely, forms the principal cause of leakage, could be removed, the insulation would be so far improved as to render the cable again available for signalling, provided the fault which is said (by those who have tested from Newfoundland) to exist in Trinity Bay was also repaired. I have the honour to be, Gentlemen, your obedient servant, F. C. WEBB."

IMPROVEMENT IN MILL-BANDS.

THE mill-owner and machinist have just been presented with a very great boon in the production of a new fabric for endless bands. These mill-bands are composed of a series of layers of canvas cemented together with the patent vegetable leather compound of Messrs. Spill. It can be fabricated to any thickness; from one to 20 strands if necessary, and in length up to 200 feet by four feet six inches wide. Hence the machinists will have the advantage of cutting their own bands to any length or width without joins, and of uniform strength throughout, at less than half the price of leather, compared with which it is considerably tougher. It will, moreover, stand the action of the atmosphere without change, is not affected by heat under 200° Fahrenheit, or by grease, alkali, or moisture. In fact, it may be used for turning wheels under water if required. It is also particularly applicable to carding engines, as it does not absorb oil, which is a great defect in leather, the wool-carders complaining of the leather becoming soddened with oil after a day or two's use, and then the leather "mats" the wool upon its surface and carries it round, clogging and accumulating the whole of the time, instead of delivering it to the other parts of the machinery as desired. The production has been severely tested, and the orders already on hand at the Government contract works, Stepney Green, have necessitated the erection of distinct and extensive apparatus for its manufacture by the Messrs. Spill, its patentees.

MIDDLETON'S PUNCHING AND SHEARING MACHINES.

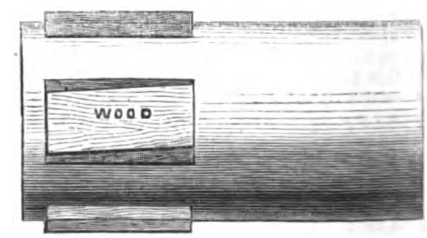


MIDDLETON'S PUNCHING AND SHEARING MACHINES.

WE have much pleasure in describing and illustrating one of the useful punching and shearing machines of Mr. W. Middleton. The engraving shows a perspective view of the same. The rise and fall of the cutting and punching block *A* is managed in the ordinary way, the edges being V-formed, and fitted with adjustable slides; the main shaft is made strong enough to take the strain without any perceptable effect from torsion. The spur-wheel *B* is shrouded, as well as the pinion, which is a great advantage in machines used for heavy rough work. The counter-spindle runs through to the front of the frame, and is fitted with a tight and loose pulley *C* and *D*, and a heavy fly wheel *E*, to secure momentum. The screws to hold the cushion *F* on which the punching is effected are tilted down so that their ends rest upon the cone, and it is in this manner that it is kept steady, and has no tendency to rise. The shearing plates *G G*, are not, as in ordinary machines, parallel to the line of the face of the press, but skewed in a slight degree, as will be seen on reference to the engraving. By this means any length can be cut off of bar-iron, and still the shears remain in the proper position for cutting down iron-plate lengthways.

These machines are made of four different sizes, the largest being of strength to punch 1-in. holes through 1-in. plates. Combining as they do the latest improvements it is not surprising that these presses are having an extensive sale. We understand that they were used by Messrs. Fox, Henderson, and Co., and that they have been already supplied to a great many of our leading manufacturers, including Messrs. James Watt and Co., Messrs. Brown, Marshall, and Co., the Messrs. Fowler, and others, giving in every case perfect satisfaction.

CAPT. NORTON'S ORDNANCE RIFLE BOLT.



THE central projecting part of each wing works in and against the bottom of the grooves; the other portion works against the edges of the grooves, and on the face of the lands, so that the projectile works and rests entirely on wood. The bore of even brass rifled cannon cannot be injured by using these projectiles, which may be of ordinary cast-iron. Additional security on this point is also gained by coating the shot with paper in the same manner as my paper-coated rifle shot described in a former number of the MECHANICS' MAGAZINE. A few days ago I fired one of these elongated iron bolts into a chalk butt in the Rosherville Gardens, from the four-grooved one-pounder rifled brass cannon from which about twenty years ago I successfully tested my *elongated* percussion rifle shells at Woolwich, in presence of a large number of naval and military officers, with perfect success; of which number the late General Viscount Hardinge was one, and who, being a *clear-headed* man and a zealous officer, wrote to me a few days after, congratulating me on the success of my experiments, adding that they would lead to the most useful and valuable results. Specimens of these shot are to be seen at the Crystal Palace, South Kensington Museum, the United Service Institution, and the grounds of the Victoria Rifle Corps, Kilburn. J. NORTON.

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TASKER'S PATENT IMPROVEMENTS IN PLOUGHS.

FIG. 1.

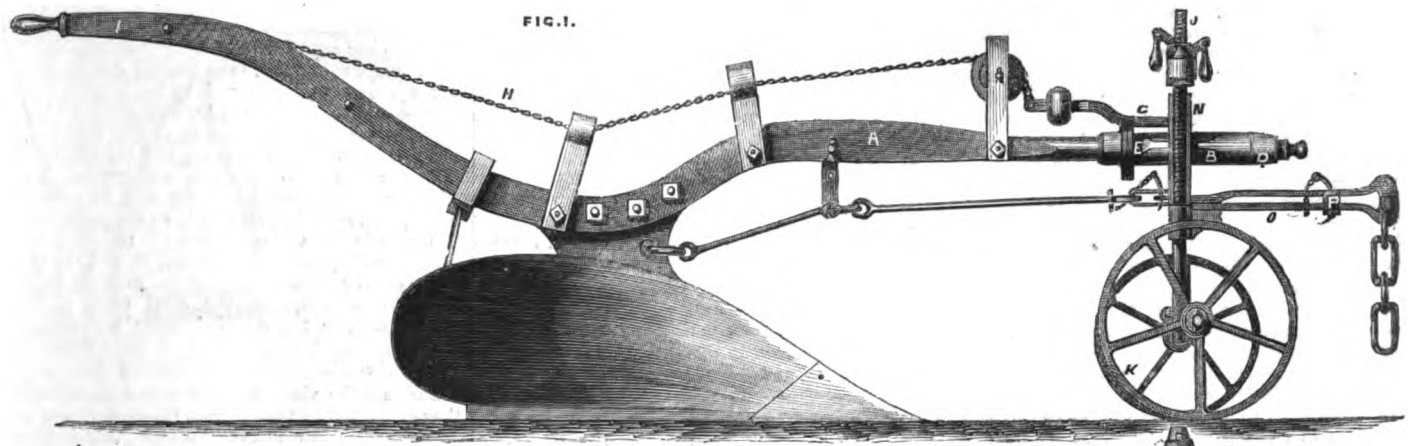
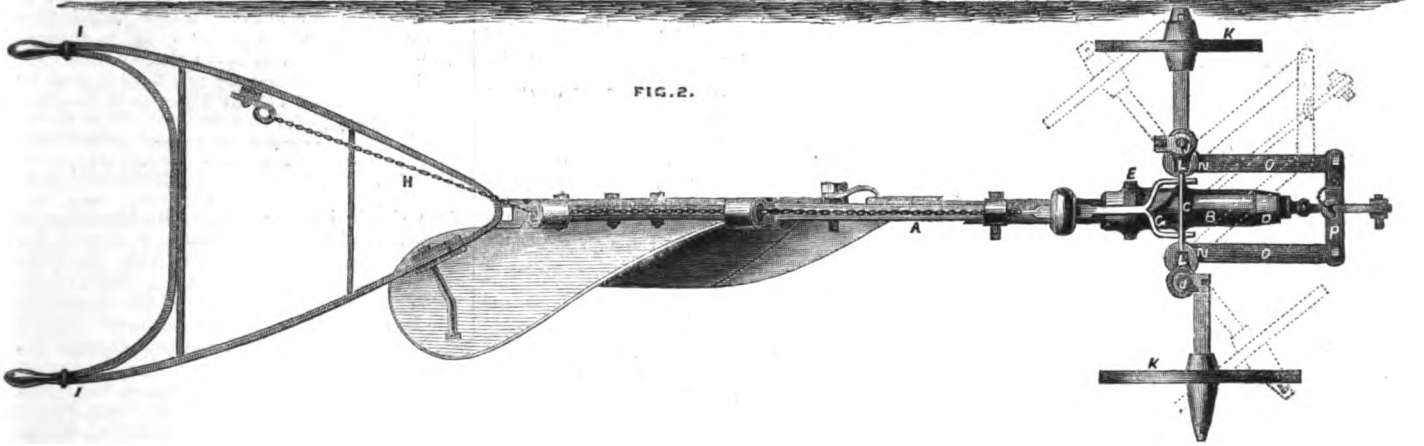


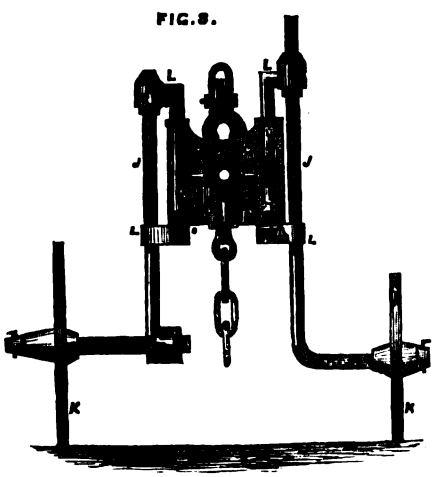
FIG. 2.



TASKER'S PATENT IMPROVEMENTS IN PLOUGHS.

MR. WILLIAM TASKER, of the Waterloo Ironworks, near Andover, has obtained a patent for an invention which relates to a peculiar construction and arrangement of the parts of ploughs, known as fixed-headed ploughs, in connection with the front end of the beam and head gear, whereby the plough may be turned at the headlands without having to be carried round by the ploughman. Fig. 1 of the annexed engravings represents a side elevation of a plough fitted with his improvements; Fig. 2 is a corresponding plan of the same, and Fig. 3 is a front view of the plough head. *A* is the plough beam, the front end of which is made round, and fits into the corresponding tube or hollow cylinder *B*, cast in one piece with the vertical frame *C*, and fitting loosely upon the rounded front portion of the plough beam, so as to be capable of turning freely thereon. The collar and pin at *D* serve to keep the end of the beam from slipping out of its place. A flange, *E*, is cast upon the back end of the tube *B*, which fits against a similar collar *F*, fast on the beam itself. These two collars are notched so as to receive the weighted fork lever or catch *G*, which plays freely in holes made in the casting, and is retained therein by cottars. When this catch is dropped into the corresponding notches in the two flanges or collars, the plough beam will be locked or prevented from turning in its tubular socket; but when the catch is elevated out of the notches, which may be effected by the ploughman pulling the chain or cord *H*, or by any other simple contrivance, the beam will be unlocked, and may then be turned over to one side so as to bring one of the handles *I I* on to the ground, and consequently raise the ploughshare, in which position the whole may be readily turned at the headlands. A skid or other convenient rest may be bolted on to one of the handles for the purpose of supporting them when on the ground. The headland being turned, the ploughman re-adjusts the beam, when the weighted catch *G* drops into the notches in the respective flanges *E*, *F*, and

FIG. 3.



locks the beam in its proper position for work. *J J* are adjustable stumps for carrying the running wheels *K K*; these stumps pass through the overhanging lugs *L L*, formed at the top and bottom of each of the round spindles *M M*, which are contained in the vertical sockets *N N* (one of which is shown in section in Fig. 3), of the cast-iron frame *C*, and are free to turn therein, thereby enabling the stump of each wheel to swivel or lock round when turning the plough, as shown by the dotted lines in Fig. 2. *O*, *O* are two bars rigidly fixed to the lower ends of the spindles *M*, and connected at their front ends by a cross bar *P*, which is provided with a number of holes for the purpose of regulating the line of draught, as will be clearly understood on referring to the drawings.

LAYING-OFF: *Erratum.*—In the italic heading, second column, page 135 of our last Number, the word "stern" was omitted by the printer. It should have read "*New Mode of Laying Off Canted Stern Timbers.*" The omission of the word will not have misled those who studied the article.

SIR HOWARD DOUGLAS'S IMPROVEMENTS ON THE SCREW PROPELLER.

THE *Times* of Saturday last contains a long article on the above subject. After adverting to the recent trials on board the Doris, and mentioning the result which was obtained, and which is so favourable to Sir Howard's views (as explained in a leading article of ours on the 17th of June last), the writer of the article proceeds as follows:—"This (the result of the Doris trials) was a great victory for Sir Howard's principles, and accordingly he received congratulations from all but the Admiralty, which alone made no sign. Upon this, after a decent lapse of time, Sir Howard wrote to the Admiralty at Somerset-house, pointing out how he was the originator of the improvement, and how he had himself directed their attention to the subject, and so induced the trials with his screw which had terminated so satisfactorily. He expressed himself delighted that his improvement had proved of such value and importance, and the only reward he wished for or would ever take was the free and just acknowledgment that to him, and him alone, was due the merit of what we may almost term the discovery. After a time, the Admiralty replied most blandly. They were delighted to forward him an abstract of the experiments made on board Her Majesty's ship Doris, and would be the last to attempt to rob Sir Howard of any credit which he thought due to his improvements. In the present instance, they intimated that there was but little chance of doing so unfair an act, inasmuch as Sir Howard's improvements of 1858 had been tried previously by the Admiralty on board Her Majesty's yacht Fairy in 1853. Now, this latter assertion is very far from being correct. The trials made on board the Fairy six years ago were with screws of a peculiar form, cut down into any or almost no form whatever. The screws, too, were utterly different in principle and pitch from the Admiralty screw which Sir Howard proposed to improve, while the trials themselves may be regarded as conspicuous failures, inasmuch as they resulted in nothing, and left the old fan-shaped Admiralty screw precisely as it was

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and as it has remained till the present improvement of Sir Howard. The gallant veteran has replied to the Admiralty, calmly persisting in his claim to the merit of having originated the improvement, and hinting strongly that the attempt of the authorities to refer back the improvement to the meaningless trials of 1853 with totally different screws looks very like trying to rob him of the honour due to his skill and perseverance in having been the first to see and the first to work out this important modification of the screw propeller principle. So the matter remains at present. Whether the Admiralty will eventually give the merit where the merit is due we know not; but in the cause of truth, and in the cause of all our earnest, thoughtful men, who so wearily and nearly always so thanklessly labour to promote the efficiency of both services, it is right that the truth should be known, and that the merit of introducing this most important improvement in the form of the screw propeller belongs to General Sir Howard Douglas, and to him alone.

"While we are upon the subject of Sir Howard Douglas's improvement of the screw we may refer to one which, though very simple, is hardly less important in degree than that we have mentioned, and one which it is certain the Admiralty must gladly adopt. We mean, of course, that improvement which is to prevent a ship's screw being fouled by rigging or hawsers. In the last great naval war with France our victories were as much gained by the skill with which we out-manœuvred our adversaries as from any other cause. This led the French to prefer always firing at the spars and rigging, while as constantly the English aimed at the hull. These have become the traditional modes of attack with both navies, and the result to be achieved by firing at the rigging now would be almost identical with what was accomplished when ships manœuvred under sail alone. A screw-liner having a mast shot away would now have her screw fouled by the wreck of the rigging drifting into her wake astern within three minutes after the spar fell over. The greater the "way" on the vessel the more certainly would such an accident occur, and in a naval engagement with a mast shot away, and her screw jammed, any vessel would be so completely at the mercy of her antagonist that further resistance would be hopeless. There are many, and some most fatal instances, already on record of the hopeless condition to which a screw vessel is reduced when once her propeller is fouled. Look at the loss of the Prince. Yet in the whole of Her Majesty's navy not a single vessel is provided with any appliance to ward off this most obvious and most serious disaster. In Sir Howard Douglas's improved form of screw the curved edges have, besides the advantage of readily throwing off any floating materials that may come in contact with them, that of not being so liable to be broken by their oblique collision with large spars. The angular parts of the common screw are far more likely to be hitched by ropes than the rounded extremities of the form which Sir Howard has now, we hope, introduced to the navy. These curved edges, he also suggests, should be fitted with sharp gun or other hard metal edges, so that as the screw revolved in the water its power would divide any rope or spar like a powerful circular saw. But his main recommendation as a remedy for this great evil is a contrivance that will enable the propeller to clear itself of any floating wreck of rigging which may hitch upon the screw in its rotation, and which, being drawn down to the root of the blade, would be wound up on the boss so tightly as to disable the propeller or break the screw-shaft, if the engines were not instantly stopped. For this manner of clearing the screw Sir Howard proposes to employ powerful and sharp knife-edges, firmly fixed to the metal trunk in which the screw works, and close to both edges of the blade, in such a manner that any rope that may have hitched on the boss would be acted upon during the revolution of the screw as a body revolving in a turning lathe is acted upon by a chisel. Thus, revolving with a force derived from the power of the engines, the rope must be drawn into and along the knife-edges, causing them to exert a drawing cut sufficient to sever any rope, whatever its strength or thickness, and so clear the screw at once of what would otherwise be the most dangerous and perhaps fatal entanglements. This simple but most efficacious plan we trust soon to see generally introduced into both the Royal and merchant navies, and hope that the Admiralty will make no attempt to purloin the merit of originating this idea as well as that of the form of the screw. How can any inventor look for success at the Admiralty when even Sir Howard Douglas, with all his claims upon the consideration of the authorities, cannot get them to acknowledge gracefully that the improvement they get for nothing is an important one, and is his?"

WILL THE GREAT EASTERN ROLL?

THIS question is discussed by a gentleman signing himself "Vates ante Factum" in the following manner:—

The leading characteristic of the Great Eastern—that in which she differs from every other ship hitherto constructed—is, he very correctly says, that she shall under no circumstances be compelled to lie to, nor in any way to diverge from her direct great circle course. She is to sail exclusively a great circle course, and is not to have recourse to any of those dodges which are resorted to to ease a ship under stress of weather. Her dimensions are (so he says) based upon certain calculations of the late Dr. Scoresby, which assigned 680 feet as the extreme length between the crests of two waves, with an average depth in the intervening trough of 60 feet, or a mean elevation and depression of 30 feet each way above and below the level of the ocean at rest. He does not wish to impugn the Rev. Doctor's experience, but, adopting his method of calculation, as detailed in an early number of *Household Words*, he (the present writer) once measured 800 feet between the crests, when lying to in the Collins steamer Baltic, in which measurement he was confirmed by Captain Comstock; and he rather thinks that Captain Harrison himself was in command of the Africa when she, starting from Liverpool three days after, experienced the same gale on the 11th of October, 1854. Now, supposing that on her voyage out to Portland (which implies on an average a W.S.W. course), she happens to be struck by a gale from due north, it is obvious, says this writer, that, if the Great Eastern is rigorously kept to her course, the trough of 680 feet wide, over which she is suspended, will not be spanned by even her great length, inasmuch as she crosses it diagonally. "Now, I contend, as the wave catches her beneath the quarter, where, from her great sharpness forward, she is rather inclined to be lean, she must roll, and, having no keel, it will be a very severe roll—not in the remotest degree dangerous, but still quite enough to discompose a landsman." In the second place, supposing she is running before a heavy gale of wind, it is equally manifest, says this gentleman, that a modification of the foregoing will take place, the difference being that, instead of rolling, there must be what is technically called a "scending" motion, with the certainty, in case of a short sea, of a very severe shock to the sternpost, though her great strength renders this comparatively unimportant. Supposing, thirdly, that, still sailing from Holyhead for Portland, immediately after rounding Malin Head or Cape Clear, she should happen to encounter a westerly gale, which is likely for the time it lasts to knock up quite as high a sea as any other, the sea will catch her, he says, on the starboard bow, while her stern is still descending into the trough. As, however, she will be advancing at a rate of about 10 knots, she will burst through the wave, quite motionless, it is true, riding majestically enough from wave to wave. As, however, the waves will pass her with their own velocity of about 30 miles an hour, *plus* her speed of 12 miles an hour, in all 42 miles an hour, there will be a tolerable lash of spray. When a ship is lying to in a heavy sea, a little dexterous manipulation of the wheel will keep her comparatively dry. Let her fall off but a single point, and, even though she has bare steerage way on her, stand by for a green sea. Such was the case with the America when she had to put back some three years ago. The height out of water of the Great Eastern, and the concavity of her upper lines forward, will prevent her taking a sea on board, but she will be covered with spray forward as far nearly as the paddlebox. The peculiarity of build already noted in her bottom will prevent her being turned, in the event of any sudden emergency, such as she is likely to meet among the coral reefs of the Eastern seas, or the crowded water highways of our own seagirt isle, except at an expense of stewards' crockery painful to contemplate.

Such are the views of this writer, and although they contain little that is new, they may serve to prevent some few individuals from entertaining absurd notions about stillness in a sea-way. We must say, however, in the above remarks the case is put rather more strongly than it need be. The steadiness of the Great Eastern will doubtless be unparalleled.

LUNGLEY'S STEERING-SIGNAL APPARATUS.

THIS simple but most ingenious invention, as applied to the Great Eastern, is due to Mr. Lungley, the shipbuilder of Deptford. By means of this Captain Harrison, or the officer of the watch on the bridge, will be enabled to steer the ship by a signal indicator with as much certainty as if he guided the wheel himself. A small illuminated dial, with a moveable index, is fixed on the bridge, in front of the officer of the watch, and connected with another of the same description in front of the men at the helm. Moving the index finger of the machine on the bridge to port or starboard moves the index of the machine before the helm at the same time, so that not a second is lost in putting the helm hard up or down. In the same manner the rudder itself is connected with another small dial before the helmsmen, which tells by its index that they have exactly obeyed orders, while this again communicating with a similar machine on the bridge shows the officer of the watch the instant his commands are executed. The movements of the latter dial being, of course, regulated by those of the rudder the officer on duty has always the helm, as it were, under his eye, and can detect if the men suffer the vessel to deviate a quarter of a point from her course even for a second. The apparatus, moreover, possesses another advantage, and that is, that simply moving over the index finger to hard a-port opens up two red lights on the port side, and by turning it to starboard a double green one is similarly displayed. Thus small vessels are afforded every facility for getting out of the monster's way in her impetuous rush over the deep.—*Times*.

A SMALL STEEL STEAMER.

THE screw steamer Little Lucy, that was lately built for river service in the Brazils, deserves especial notice in having so successfully accomplished the passage from this country to Bahia. She was 70 feet long, 12 feet broad, and 6½ feet deep, and only measured 20 tons register; and on account of the smallness of her size, it was originally intended to have her sent from this country in loose plates, which were to have been put together, and rendered fit for service on arrival at her destination; but to expedite matters it was afterwards determined to rivet her up completely, and send her over under sail and steam to South America. She was schooner-rigged, and although so miniature a craft in her appearance and proportions for so long and precarious a voyage, there was no lack of applications on all sides from captains to navigate the vessel, so satisfied was every one that she would prove a good and safe sea-boat; however, to make sure of her meriting the opinion that had

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been formed of her as regards these qualities, it was decided to send her round to Falmouth from the Tees, before she took her final departure from England, and the very severe weather she so successfully encountered on her passage round the coast, left no doubt of her performing the voyage across the Atlantic in perfect safety. Her subsequent safe arrival at Bahia fully justified the anticipations that had been previously formed of her. The material used in her construction was that known as the "Mersey Puddled Steel," and taking into consideration the smallness of the vessel's dimensions, and the thickness of the plates that composed her hull being only one-eighth of an inch, the success of the design and construction of the little vessel must be looked at upon the whole as remarkable, and proves the adaptability of puddled steel for shipbuilding purposes. The Little Lucy was built by Richardson, Duck, and Co., of Stockton, from the designs and under the superintendence of Mr. Herbert L. Thompson, naval architect, in connection with the firm of Messrs. Alfred Brett and Co., of 150 Leadenhall-street.

WRECK OF THE ALMA.

An article in our impression of last week, headed "Boat-lowering Apparatus" (written before the details of the wreck of the Alma and the loss of life that accompanied it had been given to the public), made just comment on the neglect, by owners and officers in charge of ships, of the observance of those proper and necessary precautions for the preservation of life which, in the event of accident, or at times of sudden emergency, might so materially mitigate the disasters that otherwise ensue. We even went so far as to express a hope that the time might come when captains should be put upon their trials for manslaughter should either seaman or passenger be lost from any such cause. This particular case of the Alma shows how absolutely necessary it is for the public safety that some such rule should obtain. "More than twenty persons perished from the neglect of the most ordinary precautions," says the *Times*, in a subsequent leading article on the catastrophe—in which, moreover, it has some admirable comments on the wanton neglect that led to it. Surely the strong and repeated comments of the press must eventually rouse the constituted authorities to enforce more rigidly the legal enactments which are now unhappily almost entirely disregarded, though specially framed with a view to the protection of life at sea. We refer more particularly to "Passenger Act," 1855, clause 27, 18 and 19 Vic., cap. 119; and circular No. 51, 1st Jan., 1857, "Board of Trade." While these are allowed to remain "dead letters," no wonder we have such sad histories as the Alma's to make comment on.

Law Case.

CROWN COURT.—LIVERPOOL, August 27, 1859.

(*Before Mr. Baron Watson.*)

MACNEE *v.* NIMMO.

This was an action for the infringement of a patent for making a manufacture called "Zebras." This was a new trial of the same cause.

Mr. Monk, Q.C., Mr. Hindmarsh, and Mr. Ovens appeared for the plaintiff; and Mr. Manisty, Q.C., and Mr. Jones for the defendant.

The patent claimed by the plaintiff was in a twilled or plain fabric backed so as to make it of soft or spongy texture, and printed in shawl patterns to imitate a manufacture called "Zebras," for the Eastern market. The alleged infringement was the making of a figured fabric with raised figures, upon which a shawl pattern was printed, the raised pattern giving the fabric a soft and spongy texture. This was said to be in reality the plaintiff's patent and a mere colourable evasion of it.

The case was not concluded at the rising of the Court, and was adjourned till Monday.

NOTICES.

FAIRPLAY, *Sheerness.*—As your letter on the New Works Department of the Admiralty, whether published with or without your name, would have but exceedingly little weight; as, moreover, it is written in a very improper and unbecoming tone; and as, finally, we have confidence in saying that your superior officers, on whose behalf it was written, would be greatly disgusted by its appearance, we cannot consent to publish it.

R. S.—W. P. Le Neve Forster, Secretary of the Society of Arts, in his recent paper on aluminium, gave its specific gravity as 2·6. If this is not sufficiently exact for you, you had better apply to Mr. Foster, who would doubtless furnish you with what you require.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

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Special Arrangements for larger or Serial Advertisements

To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

THE demand for Mr. E. J. REED'S paper—

ON THE MODIFICATIONS WHICH THE SHIPS OF THE ROYAL NAVY HAVE UNDERGONE DURING THE PRESENT CENTURY, IN RESPECT OF DIMENSIONS, FORM, MEANS OF PROPULSION, AND POWER OF ATTACK AND DEFENCE,"

has been so great that the Journal of the Society of Arts, the MECHANICS' MAGAZINE, and all other Scientific Journals in which it appeared in December last, are now out of print. The demand still continuing, it has been deemed desirable to reprint it in a separate form. An 8vo. edition of it, in large type, and on fine paper, has, therefore, been prepared, and may now be had at the Office of this Magazine, price 1s.

Our Weekly Gossip.

WE take the following remarks on Sir William Armstrong's career from a speech made a short time since at Newcastle by Mr. Glynn, a solicitor of that town:—"Sir William Armstrong begun his life as a useful and valuable member of the profession to which I have the honour to belong, and it was in that capacity that I first knew him. I venture to say to you, from personal knowledge, that the career which Sir William Armstrong was then pursuing was as industriously followed, as closely pursued, and as usefully carried out as that by which his name will be more generally known, and that as the attorney-at-law and solicitor in the High Court of Chancery, Sir William Armstrong was equally distinguished as he is, as not only one of the greatest of the civil but also of the military engineers of this country. When Sir William Armstrong left the profession and ceased that relationship which gave me the right to term him a brother in law, the law society, of which I am vice-president, presented him with an address; and I believe that that kindly recollection of old times and of intimate and friendly association was as grateful to the heart of Sir William Armstrong as any honours that he has received at the hands of his sovereign, or at the hands of his country. Sir William Armstrong commenced life with a very great advantage over other men. He had for his father a very eminent mathematician—a man whose profound knowledge of mathematics, although it never came prominently before the world, must have had a great effect in imbuing Sir William Armstrong with those logical methods of reasoning, and with that extreme exactness which he has carried into his future career. And I have no doubt that as Robert Stephenson owed to the careful teaching of his father in his younger days an amount of knowledge which he never otherwise would have had, and which has made him—a man of high intellect, doubtless, but still not of commanding or overpowering genius—one of the first men of the age, I have no doubt that Sir William Armstrong owed to the mathematical knowledge of his father the groundwork of that science which has since made him so famous."

A correspondent sends the following "Note on a Patent":—"When I was a boy, some thirty years since, (unfortunately) one of my favourite pastimes was to get on board the boats moored in the river of my native town at high tide, and rock in them if not disturbed by the owners. One morning, on going with some schoolfellows down to the river for that object, we made a discovery that rather astonished us, and which engrossed all our attention, for there, moored to a raft of balks, was a boat that threw all the others into the shade. This boat was about the depth of the others, but only half the width, or nearly so, and about twice the length—was beautifully painted and cushioned, and went without oars! This was effected by a pair of *paddle-wheels* fitted to the sides with crank-handles, which could be used together or separate, and the steering could be done by the foot or an inclination of the body. Now, as a boat was my hobby, I always looked forward to the having one (it has not come yet), and determined that it should be like this, because of the ease with which it could be set in motion and the comfort of seeing everything before you. This boat belonged to a gentleman who was largely engaged in the timber trade. Well, Sir, your last number containing a patent for a similar thing, astonished me nearly as much as the first sight of my favourite boat.—ROBT. ESSERY."

Arrangements have been made during the present week for taking the Great Eastern down the river to-morrow morning. At 6 A.M. she is intended to leave her moorings. Four powerful tugs will take charge of her—two ahead and two astern. The latter are to help the gigantic vessel to turn in the sharp angles of the river just between Greenwich Hospital and Blackwall. The Great Eastern herself will also be under steam in her paddle engines, which, if occasion requires, can be turned round to assist the tugs. From Gravesend to the Nore the aid of the tugs will be merely nominal, if used at all. At the Nore two or three days will probably be consumed in adjusting compasses and filling in with coal. The latter will bring her down to a fair seagoing trim—that is to say, a little over 10 feet deeper in the water than she now appears. The slightest possible addition has been made to her draught of water before the Nore is reached. From the Nore she proceeds under easy steam to Portland, and receives her passengers for the first trial trip, returning afterwards to Holyhead, from which harbour she starts on her real trial trip to Canada on or about the 15th.

Captain Norton requests that the following may be inserted:—"Gentlemen,—There was a slight error of the heading of my letter in your Magazine of yesterday. The heading should be properly, Muzzle-loading Sporting Arms. Although my gossamer cartridge equally answers for breech-loader sporting guns, yet the breech-loading are few in proportion to the muzzle-loaders. And the *million* of guerillas that I propose to follow my instructions, have only muzzle-loading sporting guns. Perhaps you will be so kind as to set this matter right in your next Magazine, as there are too many cavillers in official positions who would be ready to take advantage of the slightest slip.—J. NORTON."

Trials which have been made at Chatham recently appear to show that, in addition to their many other advantages, Major Rhodes' tents are capable of being pitched and struck in considerably less than half the time necessary for performing the same operations with an ordinary tent.

Crystal Palace season tickets, available until May next, are now issued at the uniform rate of half-a-guinea; and as, coupled with this arrangement, it is the intention of the directors to enclose and improve the concert-room, so as to render it more generally available for winter concerts, lectures, &c., during the autumn and winter, there is little doubt that a more than ordinary attendance will be maintained during the coming six months. It is during this period of the year that the Crystal Palace becomes most available. Designed by Sir Joseph Paxton especially as a winter garden, it enables the visitors to enjoy exercise and recreation in defiance of the changes of climate so frequent in England; and, as the approaches from the railway are all under cover, the palace can at all times be reached without inconvenience. It is with the view of enabling the public to appreciate more fully these peculiar advantages of the palace, that the half-guinea season-tickets have been issued, and it is gratifying to find that they have already been taken up to a considerable extent.

The National Defence Commission embarked on Monday at Portsmouth on board the Sprightly, and, with a Government pilot on board, proceeded to the Needles to inspect the western approaches to Spithead.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

Steam Engines, &c., 121.
Boilers and their Furnaces, &c., 174, 188.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 127, 131, 166.
Ships and Boats, including their fittings, 133, 137, 170, 190, 200.
Cultivation of the Soil, including agricultural and horticultural implements and machines, 138, 156, 173, 180, 183, 184, 195.
Food and Beverages, including apparatus for preparing food for men and animals, 153, 154.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 122, 141, 144, 146, 148, 152, 158, 160, 162, 175, 178, 182, 185, 191, 196.
Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 128, 155, 161, 176, 208.
Lighting, Heating, and Ventilating, 126, 129, 140, 192, 194.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 124, 147, 164, 169, 171, 179, 187, 202.
Metals, including apparatus for their manufacture, 132, 134, 139, 145, 163, 210, 211.
Chemistry and Photography, 126, 149.
Electrical Apparatus, 181.
Warfare, 157, 207.
Letter Press Printing &c., 135.
Miscellaneous, 123, 125, 130, 136, 142, 143, 150, 151, 159, 165, 167, 172, 177, 186, 189, 193, 197, 198, 199, 200, 201, 203, 204, 205, 206, 212.

121. T. Sampson. "Improvements in apparatus for feeding steam boilers with water." Dated Jan. 13, 1859.

Here at a level above the water in the steam boiler is a receiver or vessel from which the boiler is from time to time supplied with water, such vessel being of a strength suitable for resisting a like pressure to that in the steam boiler. A steam pipe from the boiler rises to the upper part of such receiver or supply vessel; there is only a water pipe which is fixed to the lower part of the receiver or supply vessel, and descends to nearly the bottom of the steam pipe, and on the water pipe is a cock, and it is preferred that these two cocks should be connected together and simultaneously opened and closed. The supply vessel or receiver receives water from an open tank above, or it may be from an open vessel or well several feet below the boiler; in either case there is a supply pipe leading from the receiver or supply vessel to the tank or well, and on such pipe is a cock which is to be opened when the two cocks above mentioned are closed, and *vice versâ*. All the three cocks are connected together by connecting rods and levers put in action by a float in the boiler, with a weight to reverse the cocks on the instant. There is an air cock at the upper part of the receiver or supply vessel to allow the air to flow out when the supply vessel is first filled out with water. *Patent completed.*

122. S. Holt. "A new and improved manufacture of woven silk fabrics." Dated January 14, 1859.

This consists in treating spun silk thread by saturating it in a solution of gum and water or a solution having equivalent chemical properties, and then in drying the thread so treated and weaving it into the fabric required; and afterwards in subjecting the fabric to heat and pressure combined to produce the requisite appearance. *Patent completed.*

123. M. A. F. Mennons. "A new or improved time measurer." (A communication.) Dated Jan. 14, 1859.

This consists in applying to time measuring apparatus the gradual flow or infiltration through porous bodies of fluids in general, and especialy of air and gases. *Patent abandoned.*

124. W. Craft and T. Wilson. "Improvements in drawers and napkins so as to render the same waterproof." Dated Jan. 14, 1859.

The object here is the manufacturing of drawers and napkins of a waterproof material having elastic bands or fastenings at their upper and lower extremities obviating the necessity of strings and buttons. *Patent completed.*

125. W. Davis. "Improvements in sluice valves." Dated Jan. 14, 1859.

Here the case is cast with a recess on one side of the water way into which the valve passes, when it is opened. The valve is circular when it closes the water passage, and it may be made with one or two bearing surfaces. The valve turns on an axis, and it is moved by means of a screw in the following manner:—The valve has a projecting arm beyond the axis of its motion, and such axis of motion is on one side of the water way or passage. To the arm or projection of the valve is attached a rod with a screw formed thereon. The pin by which the rod is attached to the arm of the valve works in a slot formed through the arm. The screw works through a stuffing box, which is kept tight by a suitable gland through which the end of the screw rod passes, and it enters a hollow tubular screw key, which is closed at its outer end, and it is fixed to the gland of the stuffing box by a second gland or cover through which the hollow key passes, and by reason of its inner end being formed with a projecting flange it turns fluid tight in a recess formed in the outer gland, so that the key can be turned and yet remain fluid tight. The recess for the valve is closed by a hollow cover fixed to the case by screws and nuts, and the screw rod works within such hollow, and the stuffing block through which it passes is formed at one end of such hollow cover. *Patent completed.*

126. J. Dauglish. "Improvements in obtaining carbonic acid gas." Dated Jan. 14, 1859.

Here carbonate of lime or other alkaline earth is distilled in a closed retort; the carbonate is placed in the retort, which is then closed so as to leave no communication between the atmosphere and the interior of the retort. The retort is heated externally by a fire, and is connected by a pipe with an air pump or apparatus for maintaining a vacuum within the retort; by this apparatus before the distillation commences the air is removed from the retort, and a mixture of the gas with air is thus avoided. As the distillation progresses the air pump or apparatus removes the gas from the retort as quickly as it is evolved, and it may be caused to pass into a gasometer in which it is stored for use. *Patent completed.*

127. R. Romaine. "An improved arrangement of portable railway." Dated Jan. 14, 1859.

Here the patentee causes distinct series of rails and sleepers alternately to come into use and sustain the pressure of the carrying wheels on the same axle, and applying sets of rails to the periphery of each wheel, so as to insure the placing on the ground of a rail of one set for its wheel to bear upon, before the pressure of the adjacent wheels is taken from the railway. The invention is not fully described apart from the drawings. *Patent completed.*

128. J. Eccles. "Improvements in the manufacture of articles from clay earths for building purposes, as substitutes for such articles as are usually formed of stone and other materials." Dated Jan. 15, 1859.

Here the patentee takes the material as free from impurities as possible, and moulds it into the required shape, either by compressing the material through moulding orifices, or by placing it in mould boxes. At the time of moulding he makes hollows or perforations of such number and extent as the shape of the articles admit of, then removes the articles to be subjected to the drying action of currents of air both hot and cold, produced by mechanical means, as described in the specification of a previous patent. *Patent completed.*

129. W. H. E. McKnight. "An upright celled boiler, applicable to all heating purposes by hot-water or other fluid." Dated Jan. 15, 1859.

This invention consists in constructing a boiler with a series of upright cells so arranged as to obtain a maximum heating surface, and at the same time to allow an unimpeded circulation of the water as it becomes heated, from the ingress to the egress pipes, by which the currents are accelerated and the heating medium transmitted more rapidly through the pipes. *Patent completed.*

130. P. A. Vietta. "Certain inks applicable for engraving and lithographic purposes." Dated Jan. 15, 1859.

This consists in combining in certain proportions the following substances:—Gutta-percha, or caoutchouc, stearine tallow or white wax, lithographic or lamp black, turpentine, bitumen, or bituminous lac and white varnish. *Patent completed.*

131. D. L. Banks. "Improvements in the method of constructing a travelling suspension rail or roadway, to be used for the cultivation of land." Dated Jan. 15, 1859.

This invention is not described apart from the drawings. *Patent completed.*

132. R. Mushet. "Improvements in the manufacture of cast steel." Dated Jan. 15, 1859.

The patentee claims the addition of a triple compound consisting of, or containing, iron, carbon, and manganese to cast-steel produced by melting granulated cast-iron, or granulated refined cast-iron, and pulverised iron ore or oxyde of iron, so that the said triple compound may be melted and combined with the cast-steel in the melting pots or crucibles. *Patent completed.*

133. W. Betts. "Improvements in the manufacture of capsules, and in the apparatus to be employed therein." Dated an. 15, 1859.

Here the capsules are formed of the usual metal, but much thicker than those ordinarily made. The patentee takes a mandril having on it an external screw of the same size as a screw formed on the neck of a bottle, and the capsule being placed in the screw mandril, the mandril and capsule are caused to rotate, and at the same time by the action of the screw, they are moved in a lateral direction. A small disc is then pressed against the capsule, which forces it into the indentations of the screw mandril, and at the same time embosses the raised portions of the screw, and a stiff screw capsule is formed. *Patent completed.*

134. R. Mushet. "An improvement or improvements in the manufacture of cast-steel." Dated Jan. 15, 1859.

The patentee claims the manufacturing of cast-steel from mixtures of the following materials melted and combined together in melting pots or crucibles, the said materials being used either with or without the addition of charcoal or other carbonaceous matter. 1. Cast-iron which has been wholly or partially decarbonised by air having been passed through it whilst in a melted state. 2. Deodorised iron ore. 3. A triple compound of iron, carbon, and manganese, such as the "Spiegel Eisen" produced in Rhenish Prussia. *Patent completed.*

135. W. Morgan. "Improvements in printing and stencilling, and in the apparatus or machinery used therein, also for certain applications of such printing and stencilling." Dated Jan. 17, 1859.

Here the inventor connects with wheels, or wheeled or other vehicles, one or more cylinders or segments thereof, which are to revolve on points or axles. These cylinders are to be moved by adhesion bands, toothed wheels, or pinions. On the surface of these cylinders the inventor fastens types or letters, and figures or designs. The cylinders revolve by the action of the wheels or otherwise, when moving the vehicle on the ground or elsewhere. The cylinders having been inked by inking rollers suitably placed, are rolled on the surface to be printed. He also places the type, &c., on bands by rivets, screws, nuts, glue, &c. These bands are to pass under the cylinders, and round, over, and under the cylinders, the object being to extend the printing surface beyond that of the circumference of the wheels or cylinders, in order that great spaces should sometimes be between each impression. *Patent completed.*

136. T. Edwards. "Improvements applicable to letter-boxes and other like receptacles." Dated Jan. 17, 1859.

This consists in cutting off communication between the upper and lower portions of the box during the time the receiving port is open by means of a flap valve jointed horizontally across the back of the box, and which is operated by the flap which closes the receiving mouth. *Patent abandoned.*

137. J. Montgomery. "Improvements in the construction of the hulls of steam and other vessels, and in the feed-water heaters, boilers, water-gauges, condensers, engines, and propelling machinery appertaining to the former, a portion of which improvements (with the exception of those on the hull), are applicable to analogous useful purposes." Dated Jan. 17, 1859.

This invention is not described apart from the drawings. *Patent completed.*

138. E. T. Hughes. "Improvements in machinery or apparatus for sowing seed." (A communication.) Dated Jan. 17, 1859.

This consists of a hopper divided into compartments, a moveable axle-tree as a distributor, and a sower or spreader having a series of spoons or blades tapered at the bottom to act as cutters or ploughshares, the said apparatus being fixed on a carriage with wheels. *Patent abandoned.*

139. P. A. de St. S. Sicard. "An improved process and apparatus for converting cast-iron into steel." Dated Jan. 17, 1859.

The patentee claims, 1, the oxidation and purification of cast-iron by causing the melted cast-iron in conjunction with nitrate of potash, or soda, or other nitrates or oxydising re-agents, to be rapidly granulated or reduced to powder by a percussive oxydising granulator for striking or projecting it against a surface or grating. 2. The application of carbonate of ammonia in the carburising process, and for decarburising the melted metal. 3. The application of nitrate of potash, or soda, or other nitrate by means of

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a perforated box or case plunged into the melted metal for decarburising and purifying it. 4. The above processes in combination. 5. The granulator. *Patent completed.*

140. S. T. COOPER. "Improvements in the use and application of artificial light." Dated Jan. 17, 1859.

The essential condition of this invention is to place a burner supplying a small jet of gas in such a position under or near to other burners that, the jet from the former being ignited, its flame shall ignite the gas from the latter when turned on. The means proposed for effecting this object is to lay down two pipes for the conveyance of the gas to be used, one of a small diameter to supply the gas to the burner with the single jet, the other of a diameter sufficiently large to supply the gas to the burners which are to be used for illuminating purposes; or the small pipe may be a branch from the larger one. *Patent abandoned.*

141. W. E. NEWTON. "An improvement in sewing machines." (A communication.) Dated Jan. 17, 1859.

This invention is not described apart from the drawings. *Patent completed.*

142. E. BROOKS. "Improvements in locks." Dated Jan. 17, 1859.

According to this invention the locks are formed with a curtain, consisting of a plate which moves on a pin or otherwise in front of the keyhole, so as to close it, with the exception of the central opening, by the motion of the lock. The bolt shoots twice by one turn of the key, whereby great security is obtained. *Patent completed.*

143. R. G. SALTER. "Improvements in apparatus for collecting or picking up letters, papers, and other articles requiring to be stamped or printed." Dated Jan. 17, 1859.

Here the patentee places the letters edgewise upon an inclined feeding tray or trough, and between or upon endless belts, which conduct them against the side of a revolving cylinder, containing on the inside one or several apparatuses for exhausting air, and perforations at intervals in the side. The face of the cylinder carries stamps or dies, which are inked upon the revolution of the cylinder by contact with an inking roller. Over another part of the cylinder is a pressure roller. The operation is as follows:—As soon as an aperture or series of holes comes opposite the feeding trough, one letter is drawn by the exhaustion of the air inside the cylinder, and held against the side of the cylinder and over the stamp or die which has been inked; the cylinder continues to revolve with the letter adhering thereto, and carries it under the pressure roller. *Patent completed.*

144. G. and J. COLLIER. "Improvements in means or apparatus for washing and drying wool and other fibres, part of which improvements are also applicable for other purposes, where steam, hot water, or other fluids are required to be conveyed under pressure through moveable connections." Dated Jan. 17, 1859.

Here the fibre, &c., is fed on to an endless apron, by which it is conveyed to another apron, and it by these aprons conducted forward and into the water or other wash liquid, and whilst the fibre is so conducted the wash liquid has motion given to it by revolving beaters to cause it to pass fully through the fibre. The fibre is afterwards conveyed to expressing rollers and dried by steam. *Patent completed.*

145. R. MUSHET. "Improvements in the manufacture of cast-steel." Dated Jan. 17, 1859.

This consists in manufacturing cast-steel by melting and combining scrap-steel, bar-steel, or blister-steel, or any mixtures of these, with wholly deoxydised iron ore and a triple compound of iron carbon and manganese. Also in mixing with the above charcoal or other carbonaceous matter. *Patent completed.*

146. J. LUIS. "A new machine for putting on, equallising, and drying the colours on paper for hanging, bookbinding, boarding and fancy paper of every description." (A communication.) Dated Jan. 18, 1859.

The principle on which this invention rests is the triple rotation of brushes imitating the work performed by the workman. The triple rotation of brushes is obtained by a disc having a continued circular movement communicated to it by bevil wheels or pulleys, placed on a longitudinal shaft, which receives its movement directly from the driving shaft. *Patent abandoned.*

147. W. NEWMAN. "New or improved furniture for window and other blinds." Dated Jan. 18, 1859.

This invention is not described apart from the drawings. *Patent completed.*

148. J. FOSTER. "Certain improvements in machinery or apparatus called 'spinning frames' and 'roving frames' employed for spinning and roving flax, tow, hemp, jute, and other fibrous substances." Dated Jan. 18, 1859.

This invention is not intelligibly described apart from the drawings. *Patent completed.*

149. G. HAMILTON. "Improvements in treating resin and resinous substances to obtain products therefrom, and in treating the products obtained from resin and resinous substances." Dated Jan. 18, 1859.

The object here is to obtain fron common resin direct by one distillation a variety of clear and pale oils. *Patent completed.*

150. H. GALLON, J. H. BEAN, and S. LUMP. "Improvements in machinery for slotting, morticeing, tennoning, and cutting wood, iron, and other substances. Dated Jan. 18, 1859.

This consists in the application of a crank or eccentric to such machines, in order to actuate the cutting tool, such crank or eccentric acting with a slide arranged to move in a slot formed in the spindle which carries the cutting tool. *Patent completed.*

151. C. D. ARCHIBALD. "Generating force." (A communication.) Dated January 18, 1859.

The nature of this invention consists in so constructing a piston or its equivalent that when acting under the pressure of fluid bodies the resistance it meets or generates shall be made to assist the process of displacing, condensing, or exhausting without waste of the elements employed. The invention is not described apart from the drawings. *Patent completed.*

152. R. A. BROOMAN. "An improved silk thread, and a new fabric made entirely or partially from the same." (A communication.) Dated Jan. 18, 1859.

The patentee claims the manufacture of an improved silk thread by combining silk waste ("*soie fantaisie*") with raw or other silk by any suitable means. Also, the manufacture of a new fabric by forming a fabric having the said improved silk thread either in whole or in part as a warp, or as a weft, or as both, by any suitable means. *Patent completed.*

153. "R. GARRETT, jun., and J. KERRIDGE. "An improved arrangement of combined threshing and dressing machines." Dated Jan. 18, 1859.

This consists chiefly in providing a single fan which draws into its case a large volume of air, and by reason of its connection with a system of air trunks and passages cause the discharge of the air at any given number of vents in broad streams suitably directed for impinging upon the falling grain and chaff. *Patent completed.*

154. J. FAWCETT. "An improved preparation of food for cattle and horses." Dated Jan. 18, 1859.

The patentee claims particularly "the use of the locust pod and bean, in combination with other suitable farinaceous substances, and the preparation of the combined ingredients in the form of cake." *Patent abandoned.*

155. R. BRADLEY and W. CRAVEN. "Improvements in machinery or apparatus for manufacturing bricks, tiles, and other similar articles." Dated Jan. 18, 1859.

This relates to apparatus for manufacturing bricks, tiles, &c., from pulverized clay by compression, the main object being to obviate the difficulties usually attendant upon the pressure of air in the material under pressure. The details are voluminous. *Patent completed.*

156. W. TROTTER. "Improvements in reaping machines." Dated January 18, 1859.

This consists in arranging the parts of reaping machines so that the parts may readily accommodate themselves to the inequalities of the ground. *Patent completed.*

157. J. H. JOHNSON. "Improvements in air pistols and guns." (A communication.) Dated Jan. 18, 1859.

This relates to children's air guns and pistols. The breech-piece is moveable, and the butt is made hollow for containing a reserve of charges. *Patent abandoned.*

158. J. THORNTON. "Improvements in carding engines." Dated Jan. 19, 1859.

This relates to applying an endway traverse motion in addition to the ordinary rotary motion to the first toothed cylinder or roller receiving fibre from the feed means, or that which delivers to the main cylinder of a carding engine in order thereby more intimately to mix or even distribute the fibres to be carded. *Patent abandoned.*

159. W. A. F. POWELL. "Improvements in stopping or closing jars and bottles." Dated Jan. 19, 1859.

Here the stopper is formed of glass or stoneware, with a shoulder on its under side, which fits on to a plain or grooved seat within or upon the neck of the jar or bottle, and an interposed washer of india-rubber. *Patent completed.*

160. P. A. SPARRE. "Improvements in the manufacture of paper, suitable for bank-notes, cheques, bills, and similar articles." Dated Jan. 19, 1859.

This consists in applying to the paper in the course of manufacture a material capable of producing therein an opaque body either white or in one or more colours, and of any required pattern or design, which opaque body will not interfere with the clearness of the printing on the surface of the paper, but will become visible so as to appear mixed up with the subject of such printing when the note, cheque, bill, &c., is held up to the light. The opaque body consists of a body not soluble in water, such as Prussian blue, red lead, white lead, &c. *Patent completed.*

161. T. CLARKE. "Improvements in the manufacture of core barrels for pipes or columns used either for railway pipes or columns, or for water pipes or for sewerage pipes." Dated Jan. 19, 1859.

Here the patentee constructs a core barrel with two rows of hinges, and without a slide or key, but with three stay bars, which stay bars, when loosened, as can be easily done, allow the core bar to leave the casting without impediment. *Patent completed.*

162. E. T. HUGHES. "Improvements in machinery or apparatus for measuring and sorting silk and other textile materials." (A communication.) Dated Jan. 19, 1859.

Here the silk, &c., is wound on bobbins or spools to a certain length, and measured with exactness by a meter or measuring machine, which stops the movement of the bobbins or spools at the time required. To sort or assay the silk, &c., the external diameter of each bobbin or spool is measured or gauged and weighted." *Patent completed.*

163. J. WHITEHEAD. "Improvements in the means or machinery for the manufacture of 'purled' wire." Dated Jan. 19, 1859.

This consists in causing the wire to wind around a taper pin at the end of a spindle having a rotary motion. A strap presses on the outside of the coil, and has a rotary motion in the same direction as the taper pin. *Patent completed.*

164. E. STEVENS. "An improved cooking utensil." Dated Jan. 19, 1859.

This consists in combining in one a meat stand, a vegetable dish, a pudding and pie dish, and a stew pan. *Patent completed.*

165. T. A. EVANS and W. J. H. RODD. "A new method of advertising." Dated Jan. 19, 1859.

This consists in making use of the bowls and stems of tobacco pipes as a medium for advertising. *Patent abandoned.*

166. W. POUPARD. "An improved wheel-skid or shoe." Dated Jan. 19, 1859.

This consists in constructing a skid or shoe for the skidding of wheels in descending inclines with a tail piece projecting from the back part and top of the skid chamber. This tail piece may be carried entirely through to the front of the shoe, and the patentee prefers to form it of wrought iron or steel, while the body of the shoe may be made of cast or wrought iron. *Patent completed.*

167. J. H. JOHNSON. "Certain improvements in the manufacture or production of lasts, boot-trees, and clogs, and in the machinery and apparatus employed in the production of such articles." (A communication.) Dated Jan. 19, 1859.

The specification of this invention is arranged under eleven heads, and the invention is not fully described apart from the drawings. *Patent completed.*

168. J. H. JOHNSON. "Improvements in apparatus for making cigarettes." (A communication.) Dated Jan. 19, 1859.

This consists, 1, in making cigarettes less tapered than heretofore; 2, in the use of paper tubes cut down to a certain distance; 3, in making the lower portion of the head of the rammer conical; 4, in addition to the upper portion of the rammer head of a cylindrical part slightly hollowed for closing the thick end of the cigarette; 5, in the use of a paper mouthpiece fitted internally with a perforated diaphragm; 6, in marking divisions on the rammer; 7, in making the mould of metal, and the funnel of caoutchouc. *Patent completed.*

169. W. CLARK. "Certain improvements in boots and shoes, and in the machinery, apparatus, and means employed in such manufacture." (A communication.) Dated Jan. 19, 1859.

This embraces various features which to be rendered intelligible must be given in detail, and that our space will not admit of. *Patent abandoned.*

170. J. C. REID and W. MILNER. "Certain improvements in the construction of ships and vessels." Dated Jan. 20, 1859.

This consists in so constructing the bulkheads that the separate compartments into which a ship may be divided may be secured against the extension of fire. The bulkheads are to be formed of two walls or plates of iron, and placed across the ship in parallel posi-

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tions, and so as to form a hollow wall or chamber. This chamber is to be filled with a fire-resisting composition. *Patent completed.*

171. H. HILLIARD and T. CHAPMAN. "Improvements in table-knives, and in table-knife sharpeners." Dated Jan. 20, 1859.

In making the "lock'd-fast" handle lateral holding projections are formed upon the tang at a short distance from the blade of the knife. The lateral holding projection may be formed with an acute longitudinal edge by which the holding recess may be formed in the handle; or the projections may be shaped like segments of screws, which may top themselves into the sides of the handle bore, and by their screw action draw the tang well into the bore. In making an "acuminator" under one modification, the wheels or steel discs may be arranged as in common sharpeners of the same class, it being preferred to use two wheels on one side with one projecting slightly between them on the other, but the mounting is formed in such a way as to guide the knife obliquely or diagonally in being drawn across the wheels. *Patent completed.*

172. A. LINDO. "Improvements in manufacturing soap." Dated Jan. 20, 1859.

This consists, 1, in a new process for the manufacture of soluble and insoluble soap; 2, in an improvement in the preparation of lyes for the manufacture of soap; 3, in the addition of certain substances or chemical matters which being added to soap made by ordinary means renders it more durable. The details of the invention are two voluminous to be quoted here. *Patent completed.*

173. W. WOODS. "Improvements in implements for ploughing, tilling, and paring land." Dated Jan. 20, 1859.

This consists in forming that part of the beam to which the shares or parers or other tools for acting on the soil are affixed in the shape of a frame, so that two or more sets of shares, parers, or tools, may be fitted to the same beam. The inventor hinges this frame at front, and on an independent frame he mounts an axis for carrying a front or guide wheel. At the back of the frame carrying the shares, &c., he places two large wheels, and causes them to travel within the path of the shares, &c. The beam frame, front wheel frame, and handles are so combined and united that upon depressing the handles, the shares, &c., are released from the soil, and the implement may then be moved or turned upon its wheels. Another part of the invention consists in forming a skeleton or open work mould-board for parers when used for paring stubble, and instead of fitting the shank of paring knives in parers closely in the eye or loop, he makes the loop sufficiently large to enable wedges or screws to be used to effect the fastening. By employing wedges and screws the knives may be readily removed; they also admit of adjustment according to their wear. *Patent abandoned.*

174. E. T. HUGHES. "Improvements for preventing incrustation in steam-boilers or other vessels." (A communication.) Dated Jan. 20, 1859.

Here the inventor employs shells, or receptacles, made of plates of metal, placed a short distance from the bottom and sides of the boiler, and also near the flues or tubes, the shells having openings so placed as to cause the fluid to circulate at a greater velocity, or be more agitated at those parts, when the boiler is in contact with the heat, which prevents the sediment from settling upon the heated parts. *Patent abandoned.*

175. T. GREENWOOD and J. BATLEY. "An improvement in the process of gassing textile fabrics." (A communication.) Dated Jan. 20, 1859.

This consists in directing the flame towards the fabric as it is travelling forward over rollers, which holds it at tension on a vertical plane on approaching the flame, by which means the fabric is brought into contact with the oxygenated portion only of the flame. *Patent completed.*

176. S. PHILLIPS. "Improvements in sliding sashes, shutters, or doors." Dated Jan. 20, 1859.

This invention is not described apart from the drawings. It consists in dispensing with pulleys, sash lines, and weights. *Patent completed.*

177. W. E. NEWTON. "Improved apparatus for measuring water and other liquids." (A communication.) Dated Jan. 20, 1859.

Here the pipe through which the liquid flows is provided with a socket for the reception of an upright tube of glass, open at bottom; in this vertical glass tube, which is furnished with a graduated scale, is inserted a rod of alabaster, or other substance which is but slowly dissolved by water. This soluble rod rests at its lower extremity in the water-pipe. As, therefore, the lower end of the rod of soluble material is dissolved away by the water, it will gradually descend, and indicate upon the graduated scale the quantity of water which has acted upon it. *Patent completed.*

178. T. GREENWOOD, J. BATLEY, and J. DOCKRAY. "Improved machinery for converting hemp and flax fibres into yarn, twine, ropes, and cordage." Dated Jan. 20, 1859.

This relates, 1, to machinery for drawing hemp and flax fibre, and consists in conveying the fibres from the retaining rollers to the drawing-off rollers by an endless band of gills or comb teeth constructed according to a method patented 9th April, 1858. It relates, 2, to the wet spinning frame used for spinning flax, and consists in mounting the retaining rollers and the back drawing-off rollers on separate beams, and rendering the beam which carries the retaining rollers adjustable by means of a rack and pinion and worm and worm wheel. It relates, 3, to machinery for dressing yarn and twisted fibres, and consists in combining with a series of friction or polishing cylinders geared carrying rollers for passing the fibres forward from one polishing surface to the next. It relates, 4, to a mode of delivery to the apparatus for laying twine cordage, &c., a regulated quantity of yarn or strands, into which, while being delivered from their bobbins, a uniform twist is thrown. *Patent completed.*

179. J. BENT. "Certain improvements in clasps or fastenings, applicable for belts, garters, and other purposes." Dated Jan. 20, 1859.

This invention is not described apart from the drawings. *Patent completed.*

180. J. SHANKS. "Improvements in mowing machines." Dated Jan. 20, 1859.

This relates to "lawn-mowing machines." The two driving rollers are loose on the shaft, and on the centre or nave of each roller is cast or fixed a clutch, or engager, which works into a clutch on the shaft on which the two rollers revolve. These rollers are loose, and are prevented from turning round by a sunk key in each. Between each clutch and in the centre is placed a spiral spring, composed of iron or steel wire, which keeps the clutches always in gear, and at the same time allows the machine to turn easily. The gear for shifting the machine to the required cut consists of a bracket fitted to each side of the machine a little in front of the cutter. A socket is cast on the bracket in each case, into which a spindle is fitted having a forked end to contain a small pulley. It is on these pulleys that the fore part of the machine rests. A toothed rack is fixed or cast on the bracket, into which a pinion works. There is a pinion on each end of a shaft working across the machine, on one end of which is placed a handle, so that by turning the shaft by the handle the bracket is made to move upwards or downwards to get the required length of cut. The apparatus for emptying the grass box consists of a rod or lever, which is made to turn backwarks or forwards on a pivot or other joint fixed on the back rail or other part of the machine. One end of the rod is fixed by two or more joints to a false end in the grass box; the other end is lengthened till it reaches the stilts or shafts, and this end is made into a handle, and by a simple throw of the handle from one side to the other, the grass is thrown out of the box by the travelling end. *Patent abandoned.*

181. J. L. CLARK and J. MUIRHEAD. "Improvements in electric telegraphs, and in the apparatus used for working the same." Dated Jan. 20, 1859.

This consists, 1, in constructing the horizontal portion of the support or bracket used for supporting the line wire insulators hollow, using malleable cast-iron, and subsequently annealing the same. 2. In serving the gutta-percha or india-rubber coating of telegraph wires with a coating of fine fibre of grass spun into a yarn or cord, and saturated with pitch, shellac, &c. The invention also comprises a method of constructing lightning conductors for telegraph wires, "detectors" for electrical purposes, and improvements in the magnets for magnetising the needles of telegraph instruments. The details of these last-mentioned features are voluminous. *Patent completed.*

182. H. SAGAR and A. SCHULTZ. "Improvements in producing pink shades on cotton fabrics or yarns." Dated Jan. 20, 1859.

The patentees first boil the cotton pieces or yarns (previously bleached) in a solution made by dissolving murexide in a solution of nitrate of lead, to which they add a solution of bichloride of mercury. The pieces when treated in this manner became a brownish red colour, and the object of the invention is to change this tint, which has heretofore been produced when dyeing with murexide into a pink colour. This they do by the use of alkalies, alkaline salts, acids and salts, and acetate of soda mixed with wheaten starch, flour, farina, gums, &c. *Patent completed.*

183. T. RICHARDSON. "Improvements in the manufacture of manure." Dated Jan. 21, 1859.

This consists in absorbing the acid by some organic material, such as sawdust or others, then mixing the phosphatic substance with this acid mixture, and allowing the whole to remain until the ordinary decomposition is completed. *Patent completed.*

184. S. OSLER and J. B. BALCOMBE. "Improvements in apparatus for treating fish, so as to adapt it for manure, and in using the same alone or in combination with super-phosphate of lime or other phosphates." Dated Jan. 21, 1859.

This consists, 1, in treating fish by applying thereto the heat of steam or heated vapour in the manner and by means of certain apparatus. 2. In the admixture of about from 30 to 50 per cent. of the aforesaid prepared fish with either manufactured super-phosphate of lime, or with ground or calcined coprolites. *Patent abandoned.*

185. L. LE PRINCE. "The improvement of ladies' boots and shoes, called the caméleon boot and the caméleon shoe." Dated Jan. 21, 1859.

The patentee constructs ladies' boots and shoes with ornamental perforations or pierced work in the upper leather or outer material, and makes a cavity between this portion of the upper leather or material and the lining, and inserts into this cavity a moveable piece of cord, or leather, or cloth, or other material of any required colour, or covered with silk or cloth. *Patent completed.*

186. G. B. HARKES. "An improved machine for washing, wringing, and mangling." Dated Jan. 21, 1859.

This machine consists of a trough which contains the water, and on which trough are placed two horizontal bars of wood, each bar having a horizontal slot for admitting the articles to be washed. Near the slotted bars two rollers are placed which turn upon their axes, the distance of the rollers from each other being adjustable. An endless band of canvas, &c., passes over the lower roller through the slotted bars, and over a small roller placed within the trough or reservoir. The slotted bars receive a reciprocating vertical motion from a fly-wheel and crank or otherwise. *Patent abandoned.*

187. G. ELLIS. "The improvement of muffs, to be called the patent reticule muff." Dated Jan. 21, 1859.

The "reticule muff" is a muff made with one or more bags inside, the opening of the bag or bags being at top or upper side of the muff, and the same closing up with snaps, &c. *Patent abandoned.*

188. J. HICK and W. HARGREAVES. "Improvements in the construction of steam boilers." Dated Jan. 21, 1859.

This consists in the use of T iron for forming the joints between the plates or hoops of which the internal flues of boilers or the shells of boilers are constructed. *Patent abandoned.*

189. R. HOWELL and R. J. WILLDER. "An improvement or improvements in taps or stop cocks." Dated Jan. 21, 1859.

This consists in the use of a packing or lining inserted and fixed in slots or depressions in the barrel of the tap or stop cock, against which said packing the plug of the stop cock works, and the said stop cock is thereby made water, gas, or steam tight. *Patent completed.*

190. C. O'HARA. "Improvements in propellers, for propelling steam-boats, ships, and vessels." Dated Jan. 21, 1859.

This invention is not described apart from the drawings. *Patent completed.*

191. W. WELLS. "Improvements in machinery or apparatus employed in spinning and twisting cotton, and other fibrous substances." Dated Jan. 21, 1859.

This relates to self-acting mules and jennies, and consists in the use of a screw or screw-shaft for putting up and drawing out the carriage instead of bands and pulleys. *Patent abandoned.*

192. A. DAVENPORT. "An improved regulating burner for gas." (A communication.) Dated Jan. 21, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

193. J. CHILDS. "An improvement in applying heat in the manufacture of artificial gums and teeth, and other articles composed of india-rubber, or gutta-percha, combined with sulphur." Dated Jan. 21, 1859.

This consists in applying superheated steam for the purpose. *Patent completed.*

194. J. H. HUME. "Improvements in warming apparatus for the feet." Dated Jan. 21, 1859.

This consists of a metal case or shallow chamber to be attached beneath the sole of the boot or shoe, and having one of its sides capable of being opened and closed. This metal chamber has fitted within it a sole piece of brick, fire-clay, &c., which is inserted in its place for use in a heated state. *Patent completed.*

195. A. J. A. GANTIER, J. G. DUMAY, and J. T.

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PERSIN. "An improved manure." Dated Jan. 21, 1859.

This consists in mixing guano with peat. *Patent abandoned.*

196. W. H. MORRISON and H. KINDSEY. "Improvements in means or apparatus employed in the manufacture of bonnet fronts, ruches, ribbon trimmings, and other goffered or plated articles." Dated Jan. 21, 1859.

This consists in means for pressing the edges of one or more rows of plated or goffered lace, &c., so as to form a flat edge on which a barrel may be applied. *Patent abandoned.*

197. J. NEWMAN. "Improvements in the manufacture of chains." Dated Jan. 21, 1859.

The patentee claims giving increased strength to draw, bench, suspension bridge, pit, and other such chains, by forming the axes of the links with recesses and bosses or curved projections. *Patent completed.*

198. B. LAUTH. "An improved mode of, and improved machinery for, rolling plates, bars, rods, and shafts." Dated Jan. 21, 1859.

Here the patentee uses pressing rollers, and causes the articles to be drawn to and fro between them by clamps or other attachments, to which a travelling motion is imparted. *Patent completed.*

199. J. EDWARDS. "Improvements in the manufacture of buckles." Dated Jan. 21, 1859.

This consists in making a link to square or whole frame buckles, so that the strap can be attached to the buckle without having a hole cut in it. *Patent abandoned.*

200. L. A. DROUIN. "Improvements in covering joinery work with metals or metallic alloys, and apparatus for the purpose." Dated Jan. 22, 1859.

The inventor makes use of a stretching or drawing bench or of a screw-press, each furnished with suitable dies, matrixes, or blocks for the purpose named in the title. *Patent abandoned.*

201. D. MOSELEY. "Improvements in the manufacture of india-rubber thread." Dated Jan. 22, 1859.

This consists in forming solid cylindrical blocks of india-rubber, and then cutting these blocks into sheets; these sheets when lapped on to a roller with a layer of cement are then cut into thread by the ordinary cutting apparatus. *Patent completed.*

202. B. TEMPLAR. "Improvements in umbrellas and parasols." Dated Jan. 22, 1859.

This consists in placing a collar of metal on the rib, and fixing it without perforating the rib, and in forming a bearing on the under part of the collar to which the outer end of the stretcher is fastened by a pin, stud, screw, or otherwise. To connect the rib to the fixed ferrule at the crown of the umbrella or parasol, the patentee forms on or connects to the inner end of the rib a hook which he hooks over a ring, and confines that ring in the ferrule. In like manner to connect the stretcher to the sliding ferrule, he forms a hook in the inner end, and passes that over a ring fixed in the ferrule. *Patent completed.*

203. E. DORSETT and J. B. BLYTHE. "Improvements in the distillation of oil from coal-tar, and in apparatus for preserving timber therewith." Dated Jan. 23, 1859.

The patentees claim, 1, the distillation of gas tar by a continuous process from the ordinary distilling vessel or vessels into other retorts, ovens, or stills. 2. The use and application of machinery for preserving railway sleepers and other timber with sulphate of copper and other preservatives. *Patent completed.*

204. M. HENRY. "Improvements in machinery or apparatus for manufacturing corks and bungs." (A communication.) Dated Jan. 22, 1859.

This specification describes an elaborate arrangement of details which can be thoroughly comprehended only by aid of reference to the drawings. *Patent abandoned.*

205. W. E. NEWTON. "Improved machinery for cutting files. (A communication.) Dated Jan. 22, 1859.

This consists, 1, in the use of a circular chisel, which is rolled over the blank; the chisel being so adjusted to the surface of the blank that it shall sink a given distance into it. 2. In holding that face of the blank which is being cut up against a face plate or rest by pressure against its opposite side. 3. In clamping the blank rigidly while a cut is being made and releasing it preparatory to its being fed. 4. In a device for holding the blank while a cut is being made. *Patent completed.*

206. T. W. RAMMELL. "Improvements in atmospheric propulsion, and the structures, tubes, machinery, and apparatus applicable thereto." Dated Jan 22, 1859.

This invention is not described apart from the drawings. *Patent completed.*

207. C. SHARPS. "Improvements in breech-loading repeating fire-arms." Dated Jan. 22, 1859.

This relates to breech-loading repeating fire-arms in which a cartridge is used consisting of a case containing the powder with a bullet attached to one end of the case, and an enlargement or projection at the opposite end for containing the detonating material. It consists, 1, in discharging a number of the above described cartridges by a projection formed on the striking portion of the hammer, and caused to rotate by the movement of the hammer, the cartridges being so arranged in respect to the projection that it will strike the edge only of each cartridge in succession. 2. In the use of a sliding barrel-block with two or more bores, in combination with spring catches attached to the stock, by which the spent cartridges may be withdrawn simultaneously from their respective bores, on sliding the barrel from the fixed breech-piece. 3. In the use of a dog or catch, hung loosely to the hammer, and adapted so as to fit into a notch or recess in the stationary breech, so as to form a check for the hammer, and prevent premature discharge of the cartridges by maintaining it in contact with their detonating ends. 4. In introducing a hard steel centre-piece into the end of the barrel-block at such a point that it will form a species of anvil or base to receive the blow of the projection on the hammer, as the latter strikes each cartridge in succession. *Patent completed.*

208. R. BARTER. "Improvements in heating and ventilating buildings, and in apparatus connected therewith." Dated Jan. 22, 1859.

Here the inventor admits the air to the heating-furnace by a number of small apertures made underneath the fire-bars on each side of the ash-pit, the air being brought by flues or passages from near the ceilings of the hot rooms, and its place therein supplied by fresh air admitted near the floors. There are other features included. *Patent completed.*

209. W. C. HOMERSHAM. "Improvements in floating gridirons or stages for repairing ships or other vessels." Dated Jan. 24, 1859.

Here the patentee combines two series of hollow air-tight caissons placed transversely to each other, so as to form or constitute a rigid structure on which the platform for carrying the ship is fixed. *Patent completed.*

210. R. MUSHET. "Improvements in the manufacture of cast-steel and iron." Dated Jan. 24, 1859.

This consists in adding to cast-iron during the time that it is being decarbonised by the action of air forced or passed through it whilst in a molten state successive quantities of a triple compound consisting of iron, carbon, and manganese. *Patent completed.*

211. R. MUSHET. "An improvement in the manufacture of cast steel." Dated Jan. 24, 1859.

This consists in adding together, melting, and combining in melting-pots or crucibles the following substances:—1. Crude steel, which the patentee terms "iron-ore steel," obtained from iron ores or oxydes of iron, first deoxydised or deprived of their oxygen by cementation with carbonaceous matter, and then converted into a steel by a further cementation in contact with carbonaceous matter. 2. A triple compound consisting of iron, carbon, and manganese, such as the "Spiegel Eisen" of Rhenish Prussia. *Patent completed.*

212. R. A. BROOMAN. "Improvements in pumps." (A communication.) Dated Jan. 24, 1859.

This consists in constructing and arranging the parts of pumps as follows:—The barrel or cylinder of the pump is placed with its axis horizontal, and is furnished with four valves, two of which are in the upper side and near the ends, and two in the lower side near the ends. The two lower valves open into two suction pipes, which meet and lead by a single pipe into any suitable reservoir. The two upper valves open into a closed chamber which acts as an air chamber, and into which the delivery pipe dips. The piston which moves to and fro in the barrel or cylinder is formed of two discs, say of iron, between which are placed two larger discs of leather, or other like material, the edges of which turn over the edges of the iron discs and lie against the cylinder. The inner end of the piston rod passes through all the discs and has screwed upon the extremity of it a nut which keeps the whole together. The piston-rod is furnished at its outer end with a cross-head, the ends of which carry other rods passing back along the outside of the cylinder through guides on its sides. Above or below these rods are other rods oscillating on centres, and carrying handles like those of ordinary pumps. From the middle of these rods depend or stand up (as the case may be) grooved side pieces, in the grooves of which rollers attached to the side rods of the piston are confined, so that as the handles are worked up and down the piston rod and piston may thereby be caused to reciprocate. By mounting the machine with a reservoir on wheels it may be made fit for use as a fire engine, and by connecting it with other suitable appliances it may be rendered applicable as a ship pump, or as any other ordinary kind of pump. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated July 30, 1859.

1768. A. B. Seithen. Improvements in cases or boxes, and in casings, hampers, baskets, and wrappers for holding bottles, jars, and other articles.

Dated Aug. 1, 1859.

1778. E. Merrell. Improvements in apparatus for washing and cleansing.

Dated Aug. 4, 1859.

1800. E. J. Cordner. Improvements in the application of kites to the saving of life and property from shipwreck, and to other purposes.

Dated Aug. 5, 1859.

1808. R. T. Pattison. Improvements in dyeing certain woven fabrics.

Dated Aug. 8, 1859.

1822. J. Cunningham. Improvements in and connected with Jacquard apparatus for weaving.

1824. R. A. Brooman. Improved means of preventing incrustations in steam-boilers. A communication.

1826. L. B. Ollivier. Improvements in closing or stoppering bottles, jars, and other receptacles.

1827. B. Baugh. Certain improvements in the mode and apparatus for partially forming, and finishing the edges of certain description of vessels formed or raised from sheet iron or other metal.

1828. J. H. Johnson. An improved signal light, and in the apparatus employed in the production thereof. A communication.

1830. G. T. Bousfield. Improvements in revivifying the scarlet colour of woollen cloth, lace, and embroidery in use for military and other garments and furniture. A communication.

1832. J. B. Babcock. Improvements in umbrellas and parasols. A communication.

Dated Aug. 9, 1859.

1834. N. Kenward. Improvements in constructing tubular steam boilers.

1836. J. Cannon. Improvements in washing machines. A communication.

1838. C. L. J. Dierickx. A new system of scales, to be used principally in the fabrication of coins.

1844. W. Williamson. An improved machine or tool for drilling holes.

1846. J. H. Johnson. Improvements in destroying noxious exhalations. A communication.

Dated Aug. 10, 1859.

1850. T. A. Temperton. Improvements in pipes for smoking tobacco.

1852. G. Capper. Improvements in the permanent way of railways.

1854. J. J. Speed, jun. Improvements in the manufacture of pipes, tubes, and hollow cylinders.

Dated Aug. 11, 1859.

1855. R. and G. Heaton. Improvements in coining machinery.

1857. J. T. Pitman. A composition applicable to the lubrication of machinery and to various other uses. A communication.

1858. W. Bouch. Improvements in breaks, in buffers, and in couplings to be used on railways.

1859. D. Hulett and G. Prudden. Improvements in apparatus for the manufacture and distribution of gas, and in apparatus applicable for internal or external illumination.

1860. W. De la Rue and Dr. H. Müller. Improvements in treating Japan and other vegetable wax.

Dated Aug. 12, 1859.

1862. W. Clark. Certain improvements in oscillating engines. A communication.

1863. A. Evaux. Artificial marbles.

1864. W. H. Tooth. Improvements in the mode of cleaning or laying the dust of pavements, roads, or other surfaces.

1865. J. Philp. An improved hobby-horse or child's exerciser.

Dated Aug. 13, 1859.

1867. D. Campbell. Improvements in the preparation of oils for medicinal and other purposes.

1868. J. Brown. Improving false shirt fronts.

1870. W. Green and W. and F. Fawcett. Improvements in the manufacture of rugs.

1871. R. Clegg and R. Fell. Apparatus for obtaining aërated fresh water from salt water.

1872. J. and W. Stuart. Improvements in nets for fishing, and for other purposes.

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1873. K. Bühring. An improvement in obtaining spring power, and in its application to various purposes.

1874. R. L. Watts, J. Offord, and J. R. Thomas. A method of condensing and consuming smoke and other products of coals, ores, and similar substances, and reducing them to useful materials.

1875. H. T. Lambert. Improved apparatus to be adapted to ships' tackle or boats, for the purpose of facilitating the disengaging of ships' boats when lowered into the water. A communication.

1876. E. Sloman. An improved feed water and heating apparatus. A communication.

1877. J. R. Rostron. Improvements in locomotive furnaces.

1878. C. MATHER. Improvements in machinery for stretching, drying, and finishing fabrics.

Dated Aug. 15, 1859.

1879. S. Harrison. Broiling of chops or any other kind of meat.

1880. J. Jeyes. An improvement in the manufacture of boots and shoes.

1881. C. Kisky and W. Jones. Improvements in the construction of sideboards.

1882. C. Glassbrow. Improvements in pianos.

1883. J. Chanter and D. Annan. Improvements in apparatus for supplying air to furnaces.

1884. E. Stone. Improvements in machinery for cutting veneers. A communication.

1885. J. Poupard. A certain elastic combination to be used for blackleading stoves and other ironwork.

Dated Aug. 16, 1859.

1887. H. Batchelor. Improvements in steam and other motive power engines.

1889. W. Gossage. Improvements in the treatment of certain offensive liquids and of noxious gases liberated from such liquids.

1890. J. C. Haddan. Improvements in wads for projectiles, and in projectiles to be used therewith.

1891. J. C. Haddan. Improvements in machinery or apparatus for rifling cannon.

Dated Aug. 17, 1859.

1893. H. Medlock. Improvements in Portland and Roman cement, lime, and other similar kilns or furnaces.

1895. R. A. Brooman. Improvements in locks and keys. A communication.

1897. A. Yockney. Improvements in refining and compounding oils or fatty matters with other substances for lubricating and other purposes.

Dated Aug. 18, 1859.

1899. J. Drabble. An improvement in sewing machines.

1901. H. J. Hyams. Improvements in the construction of wet gas-meters.

1903. W. Wilson. Improvements in the manufacture or production of bricks, tiles, and other articles of earthenware, and in the machinery or apparatus employed therein.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Aug.* 30, 1859.)

949. G. Ashcroft. Hydraulic machines.

954. J. Glasgow and S. Hand. Circular motion.

967. J. Luis. Raising water. A communication.

992. Q. Beck. Stoves. A communication.

1008. E. Clark. Sewing machinery. A communication.

1020. P. L. M. Debain. Motive power.

1024. R. A. Brooman. Manufacture of cloth. A communication.

1025. J. Marshall, jun. Filtering fluids.

1036. A. W. Gadesden. Sugar.

1037. E. Humphrys. Steering.

1039. H. C. Hurry. Motive power.

1045. W. E. Newton. Nitric acid. A communication.

1048. R. A. Brooman. Paints and colours. A communication.

1049. R. A. Brooman. Steam boilers. A communication.

1050. J. H. Johnson. Fibrous substances. A communication.

1061. T. Lacey. Gas regulators.

1062. Sir T. T. Grant. Cooking apparatus.

1067. R. Harrington. Umbrellas and parasols.

1072. J. Wheat. Drilling machines.

1076. W. Corbett and W. Carmont. Furnaces.

1079. E. A. Porteus and W. H. Burke. Presses.

1107. W. Clark. Alkalies. A communication.

1129. W. Clark. Drills. A communication.

1259. E. Pasquier. Drying wool.

1318. T. Wilson. Fire-arms and ordnance.

1440. S. Levy. Coverings for the head.

1443. J. Luis. Gas burners. A communication.

1444. L. Barroux. Railroad.

1500. G. T. Bousfield. Winding. A communication.

1572. E. A. Wood. Raising and lowering boats.

1601. J. Luis. Washing wool. A communication.

1749. C. W. Smith. Electric telegraphs.

1774. W. Campbell and G. Worstenholm. Nails. Partly a communication.

1840. G. T. Bousfield. Vulcanizable gums. A communication.

1843. J. D. Bryant. Lime.

1872. J. Stuart. Nets.

1903. W. Wilson. Earthenware.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2006. B. A. Graautoff and C. H. W. Albrecht.	2023. J. Gregory.
2007. T. Watson.	2038. G. Anderson.
	2102. C. Brook, jun.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Aug. 27, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
1376	7	1600	4	1750	3	1900	9	2050	11	2210	7
1380	3	1610	10	1760	8	1910	3	2060	11	2220	3
1400	3	1620	10	1770	6	1920	5	2080	7	2230	10
1420	7	1630	3	1781	8	1930	10	2090	10	2240	3
1430	7	1640	3	1790	7	1940	6	2100	4	2250	3
1490	7	1650	3	1800	3	1950	3	2110	5	2260	3
1500	10	1660	6	1810	8	1960	3	2120	6	2270	10
1520	3	1670	10	1820	3	1970	1	2131	1	2280	3
1532	9	1680	10	1830	3	1980	10	2140	8	2290	3
1540	4	1690	3	1840	3	1990	3	2150	3	2300	6
1550	10	1700	10	1850	10	1900	3	2162	8	2310	3
1560	10	1710	7	1860	3	2010	3	2171	1	2320	3
1570	3	1720	4	1870	3	2020	6	2181	6	2330	3
1580	3	1730	3	1880	3	2030	10	2190	3	2340	6
1590	6	1740	3	1890	7	2040	3	2200	3	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

HARBOUR WORK, *Scotland*.—For the Elgin and Lossiemouth Harbour Company. Contractors are wanted for the excavation and completion of a new bason, and for building a sea-wall, according to plans, sections, and specifications prepared by J. Abernethy, Esq., C.E., London; to be seen at the Town Clerk's Office, Elgin; or at the Harbour Office, Lossiemouth. Tenders with Mr. Duff, Town Clerk, Elgin, noon, September 10.

RAILWAY, *Ireland*.—The plans, sections, working drawings, and specifications of the extension from Newtonards to Donaghadee, with branch to Bangor, of the Belfast and County Down Railway, are now for inspection at the office of the Company, Queen's Quay, Belfast. "The day for receiving and opening tenders will be stated in the specification," the advertisement says.

WROUGHT-IRON BRIDGE, *Victoria Railway*.—Tenders are invited for the girders of a wrought-iron bridge for the above railway. Specifications, 4 Abchurch-lane, and further information J. K. Brunel, Esq., 18 Duke-street, Westminster. Tenders to De Pass and Sons, 4 Abchurch-lane, September 6, before 3 o'clock.

ROLLING STOCK, *Victoria Railway*.—For 4 first-class carriages, 4 second-class and 1 break van. Specifications, 4 Abchurch-lane, Tenders before 4 o'clock September 12, to Messrs. De Pass and Sons.

RAILS, *London, Brighton, and South Coast*.—For the supply of 1,000 tons of double-headed rails, 75 lbs. per yard. Specifications and forms of the Storekeeper, Mr. W. Walker, Railway Terminus, Brighton. Tenders to Mr. Frederick Slight, Secretary, London-bridge Terminus, by 10 a.m., September 8.

WATER WORKS, *Skipton*.—For the construction of a Reservoir, Filter Beds, Grating Tank, Regulating Tank, Pine Water Tank, Bye Wash, and other works connected. Plans, &c., of Mr. T. Curley, C.E., Local Board of Health Engineer's office, Skipton. Tenders, Mr. Calvert, Skipton, Clerk to Skipton Water Works Company.

CAST-IRON SCRUBBERS, *Burnley*.—For the erection of 4 cast-iron scrubbers, with 15 inch slides, valves, force-pump, and connections complete, for the Burnley Improvement Commissioners. Plans and specifications at the Gas Works, Burnley. Tenders to W. M. Coultate, Esq., Burnley, Chairman, September 5.

WATER-PIPES, *Cheshire*.—The directors of the Wirral Water Works Company are prepared to receive tenders for the delivery of water-pipes, according to specifications for the townships of Oxton, Tranmere, Preuton, Rock Ferry, in Bebington, &c. Specifications, Mr. Cunningham, Engineer, 5 Cook-street, Liverpool. No date given.

SEWERING, PAVING, &c., *Manchester*.—For sewering, levelling, paving, flagging, channeling, and completing the parts of 4 streets within the Newton district. Particulars, Messrs. Corbett and Raby, Surveyors to the Newton Heath Local Board of Health, Queen's Chamber, Market-street, Manchester, September 15.

STONE BRIDGE, *Blackburn*.—For the erection of a stone bridge across the river Ribble, in the jurisdiction of the Blackburn and Preston Turnpike Road and Bridge Trustees. Plans, &c., with printed forms, Clerk of the Trustees, Sharrock Fold, Blackburn; to whom tenders, September 14.

NEW SEWERS, *Derby*.—Also the construction of flushing cisterns, side entrances, &c., in several roads and streets. Plans and drawings, Offices of the Local Board of Health, Full-street, Derby. Tenders to September 6th.

CEMETERY WORK, *Bacup*.—For the draining, excavating, and boundary-walling at the new cemetery, Fairwell. Plans, &c., Office of Mr. S. Hall, Clerk to the Burial Board, Irwell Terrace, Bacup, on September 12. Tenders.

FOUR COTTAGES, *Staffordshire*.—For the erection of four cottages at Gnosal, belonging to the trustees of charities. Plans, &c., at the school-house. Tenders, Rev. J. Fill, Gnosal Parsonage, September 8.

BUILDINGS, *Spaldington, near Howden, East Yorkshire*.—For various buildings upon the estate of Sir H. Mervyn Vavasour, Bart. Plans, &c., after Monday next at the residence of Mr. Carmichael, Spaldington; and a duplicate copy at 22 Sackville-street, London, up to Sept. 8; afterward at 17 Tenant-street, Derby; at which two last-named places bills and forms, the architects being Messrs. Stevens and Robinson, of Derby and London. Tenders by noon, Sept. 12, to Sir Henry M. Vavasour.

SCHOOL AND MASTER'S RESIDENCE, *Llanairk, near Aberayron*.—Plans, &c., Rev. D. J. Jones, Vicar of Llanaith, or at Mr. Withers, Architect, 51 Doughty-street, London. Tenders to Sept. 10th.

PEWTER WARE, *Navy*.—The contract for a period of 4 years certain, commencing January 1, 1860. Forms and information, Steward's Office, Greenwich. Tenders, Sept. 8, at Greenwich Hospital.

MARKS OF DISTINCTION, *Navy*.—For supplying and delivering into Her Majesty's Victualling Stores at Deptford, Gosport, and Plymouth, all such marks of distinction for petty officers and leading seamen of Her Majesty's Navy as shall from time to time be demanded under a contract for 12 months certain, and further until the expiration of 12 months' warning. Patterns at the office of Comptroller for Victualling, and at the Victualling Yards at Gosport and Plymouth, where may be seen the recent modification of the conditions of the contract, to which particular attention is drawn. Tenders, Sept. 8.

ROAD SURVEYOR.—The trustees of the Yoker and Great Western Roads will elect a Surveyor to fill a vacancy that has just occurred, on the 14th inst., at two o'clock, at the George Hotel, George Square, Glasgow. Applications to the Clerk of the Roads, Glasgow, Sept. 14.

MANAGER FOR TAR AND AMMONIA WORKS.—For the country. One with a practical knowledge of artificial manure making will be liberally treated with. Address, Walmsley and Co., Advertising Agents, 4 Old Millgate, Manchester.

SETTER OF CARDING ENGINES.—Composed of rollers, clearers, and flats. A man with a knowledge of roving frames preferred. Victoria Mills, Pacricroft, Manchester.

FOREMAN ENGINEER.—Competent to take charge of erecters and fitters, and assist in the general management of an engine works of about 40 hands. Address, in confidence, stating qualifications and terms expected, C. 30 Office of the *Manchester Examiner*.

ENGINE FITTER.—Accustomed to locomotive work. Constant employment. No club-man need apply. Address, F. 55, Office *Manchester Examiner*.

PRICES CURRENT OF METALS.

London, 2nd Sep., 1859.

	£ s. d.		£ s. d.	Dis. p. ct
IRON, Rails in Wales and N.				
of England ..... pr. ton	6 0 0	to		nett
Welsh Bars, in Wales .. „	5 17 6	„	6 0 0	2½
Staf. Bars at the Works „	7 0 0	„	7 10 0	2½
„ Hoops ..... „	8 0 0	„	8 10 0	„
„ Sheets, Singles .. „	8 10 0	„	9 0 0	„
„ Nail Rods..... „	7 0 0	„	7 10 0	„
„ Boiler Plates .... „	8 10 0	„	9 0 0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow..... „	2 12 3	„	2 12 6	nett
Do. No. 1, Good Brands „	2 12 0	„	2 14 6	„
Scotch Bars ..... „	7 10 0	„	8 0 0	2½
Swedish Bars, in London „	12 0 0	„	15 0 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 12			2½
Tough Cake and Tile „ ton	107 10 0			„
Best Selected..... „	110 10 0			„
Australian ..... „	110 0 0	„	110 10 0	„
South American ... „	103 0 0			„
Yellow Metal Sheathing..... per lb.	0 0 10			„
STEEL, Swedish Keg ..... pr. ton	19 0 0			2½
„ Faggot ..... „	21 0 0			„
TIN, English, Block ..... pr. cwt.	6 16 0			2½
„ Bar..... „	6 17 0			„
Foreign, Banca ..... „	7 3 0			nett
„ Straits..... „	7 0 0			„
TINPLATES, Charcoal, I.C. ..pr. box	1 12 6	„	1 13 6	5
Coke, I.C. ..... „	1 5 6	„	1 7 6	„
LEAD, Pig, English ..... pr. ton	22 15 0	„	23 5 0	2½
„ Spanish ..... „	22 0 0	„	22 10 0	„
Sheet ..... „	23 15 0	„	24 0 0	„
SPELTER, on the spot ..... pr. ton	21 0 0			nett
for arrival..... „	21 10 0			„
ZINC, English, Sheet ..... „	26 0 0	„	27 0 0	1½
QUICKSILVER ..... per btl.	7 0 0			1½

REMARKS.—A very moderate amount of business doing, with scarce any fluctuations in price.

LAWRIE AND HAGGER, Metal Brokers.
83 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 9, 1859.

OUR SCREW SHIPS.

"THERE is," says the old proverb, "no royal "road to learning," nor is there, we are persuaded, to excellence or worth of any kind. We nearly always estimate the value of any production of hand or brain by the amount of manual or mental labour which has been bestowed upon it. The capacity to toil and to endure is our human capital, and is the source of nearly all human success. Perhaps none are more sensible of this than literary men. They know it to be possible to spin out a few new ideas or facts into lines and columns, and even to reproduce old ones with some show of freshness; but they know also that, even commercially, the value of what they write is dependent upon the amount of useful material embodied in it. A new fact is the virgin ore of the journalist, which is made to assume a thousand forms, and serve a thousand purposes, as it passes on from hand to hand. But "all is not "gold that glitters;" much base metal is turned to account by unscrupulous or ignorant workmen, and may long escape detection. We have instances of this constantly before our eyes in our periodical literature, especially with regard to scientific matters; and we think it our duty to notice a recent case, not only because it appears in a journal which has some pretensions to authority in the matters of which it treats, but because the article in question has been transferred to the columns of the *Times*, and may work mischief. We refer to a leading article which appeared in the *United Service Gazette* of the 3rd inst., on "Our Screw Ships." It is asserted that "we go on building and "altering" our ships of war "without any visi- "ble improvement. Ships and engines are con- "structed at an enormous cost, and when "completed we find no perceptible gain." To support this statement they say: "The Aga- "memnon, a two-decker, one of the first ships "built for the screw, steamed 13 knots with "650 horse power; the Mersey, a single-decked "ship, nearly 100 feet longer, and with 1,000 "horse power, goes very little faster, while the "Orlando, another single-decked ship, 50 feet "longer than the Mersey, with power working "up to 4,000 horses, has only been propelled "about a half knot more than the Agamemnon. "On the other hand, we have the Himalaya "doing 16 knots with 700-horse power, only "partially exerted."

Now, this is an entire tissue of mis-statements. The Mersey is 70 feet longer than the Agamemnon, instead of 100 feet; and the Orlando is exactly the same length as the Mersey, instead of being 50 feet longer; so that while the Orlando is made out to be nearly 150 feet longer than the Agamemnon, she is really but 70 feet longer. The Agamemnon of 600, not 650, nominal horse power has, we believe, never obtained a greater speed than that recorded in the Admiralty Tables, recently published by us, viz., 11 knots, while both the Mersey and the Orlando have reached 13¼ knots or 15¼ miles per hour. Again, the nominal horse power of the Himalaya is 700, but when the engines were worked up to 2,014 horses power the speed was 12·922 knots instead of "16 knots "with 700-horse power, partially exerted!" With the piece of gossip that the "General "Admiral is said to go 15 knots," we have nothing to do; we can only say we do not believe it.

After making these remarkable statements, the writer goes on to say, "The impression "left in our mind by the experiments on board "the screw frigates is, that there is a consider- "able excess of power developed, which is, in "fact, wasted, and that the waste retards rather "than accelerates the speed." "We see no "reason to doubt that the Orlando would attain "a higher rate of speed with 500 or 600 horse "power, moderately used, than with 1,000." How a sensible man could write such nonsense as this, we are at a loss to conceive. Is it necessary to tell any of our readers that the power of an engine can be reduced at a moment's notice, as much as ever we please? Why, the ordinary steaming of the Orlando, and of every ship in the Royal Navy, is performed with only one-half the real power of the engines, and it is only on extraordinary occasions that their full power is called out. The officers of the ship may always discover what effect a reduction of engine power would have upon her, even taking into account the reduction in weight; for the difference in the draught of water caused by taking out the coals will generally be much greater than by any reduction which could be made in the weight of engines; so that by regulating the quantity of coals in the bunkers they can assume what conditions they please. While we possess such a simple means of experimenting, and while, moreover, we have such a mass of experiments already made, it is idle to discuss such cases as that of the Vectis, which, we are informed, "would only steam 14 knots "with 400 horse power," but "goes 14¼ with "250." For anything we know to the contrary the effective horses' power developed by the small engines, and therefore the quantity of fuel consumed, may have been greater than by the large ones.

There is really no ground whatever for the assertion that we find "no perceptible gain" in our ships of war. The speed of the Mersey and Orlando is, reasoning from the Agamemnon, as high as could be expected when the difference in the immersion of the screw is taken into account. According to the ordinary theory, which is known to be defective, the indicated horse power in the same ship, or in similar ships, varies as the cube of the speed. We should therefore conclude that if 1,839 horses' power gave 11 knots in the Agamemnon, as they did, 4,000 horses' power would give a little over 14 knots. No one at all acquainted with the subject would have expected to realise this in the Mersey and Orlando, and we believe the Admiralty are very well satisfied with the results they have obtained in those ships.

THE BUILDERS' STRIKE AND LOCK-OUT.

IT must be with some degree of diffidence and caution that an impartial writer will treat such a question as the strike in the building trades which for some time has engaged public attention. In the first instance, it is a question which mainly regards the masters and the men, and can be decided by them alone. Hitherto the law has pronounced neither to be aggrieved. Both parties may be presumed in practice to be the best judges of their own position and interests. And consequently there is no occasion for any violent intermeddling on the part of the public or of the press. Newspaper articles such as we have lately seen—flippant and somewhat arrogant in their tone, upholding capital on principle, and blaming the workmen on the inadequate grounds that he disturbs the convenience of his late employers in adopting what he considers the most effectual means of advancing his own interests—can only serve to irritate and strengthen the mutual opposition. They may harmonize with the ideas of "order" held by a class whose sympathies are not extended to the worker, whether he be right or wrong in his struggle against capital; but they must lower the press in the eyes of many men who perforce have had this theme before them during long weeks of anxiety—perhaps of privation. In poverty and hunger these men have stronger appeals to urge the present expediency of submission than any they can receive from the *Times* or from the *Globe*. We believe they are ready to learn their own interests from those who are capable of teaching, and who they have reason to think will advocate the same. But they must see, in presence of past experience, the absurdity of condemning without qualification the course they have followed, or of accusing them of folly upon other premises than that of ultimate failure. Nor can this premise be assumed without contradiction. Strikes have *not* always been unsuccessful, and rumours of strikes have *not* always been without benefit. So long as the present relations between capital and labour remain unaltered, the strike of the workman on the one hand, and the discharge of the labourer when no longer required on the other, must be converse and necessary phenomena in the history of supply and demand.

Leaving all other questions of expediency out of the question, it is evident that the ultimate result of success or non-success can alone decide the policy of this particular movement. To tell the working men that they are wrong in their policy before this result is proved—before even it can be fairly asserted one way or the other—is a presumption and a fallacy. We believe ourselves that "strikes," so detrimental in themselves, are necessary only in rare and exceptional cases. In the present instance, if unsuccessful, it will be evident that the strike was not called for by the conditions of the labour market. But, on the other hand, the principle which has led to this manifestation is probably more conducive to the ultimate interests of the employed than would be a tame submission to the dictates of capital. The value of labour, like that of any other commodity, must be fixed by mutual agreement between the buyer and the seller; and this agreement cannot always be arrived at without dispute. When the true value cannot be recognized, and a misunderstanding arises, the difference of opinion may be prejudicial to both buyer and seller; but less so to the latter than if the question had been left in the hands of the former alone. Nor are there any grounds to make this difference of opinion the subject of a quarrel, or the occasion of vindictive feeling. It is to be observed, in opposition to the argument of a distinguished contemporary,* that what in this case occurs individually may also occur collectively; for competition alone can by no means always determine the actual value of a commodity, and, indeed, often tends to lower the price in undue measure.

Among those who would insist upon the subserviency of labour to the dictum of capital, there may be many who consider it as a necessary principle, and conducive to the interests of the employed. A portion of those who hold this view may be capable of sympathy with labour, and willing to recognize its claims. But these cannot go so far as to ascribe moral wrong to the artizan who would raise the commercial value of his labour by carrying out in practice the opposite opinion. Those who would meet the assertion of a natural right with the opprobrium bestowed upon the disturbers of "order," or the disciples of democratic notions, must be influenced by the selfish and illiberal prejudice of class, which is equally incompetent to form an unbiassed judgment and unworthy to take part in a discussion involving the interests of

* The *Saturday Review*.

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the working classes. The sympathies of such men must ever be adverse to the cause of labour, and their opinion is worthy of little respect or consideration. If sympathy, instead of calm and practical discrimination, were called for, it should be due to those men who are engaged in an unequal struggle to maintain their convictions, rather than to the possessors of that capital which has been accumulated by means of their toil, and which, intrenched in the "Three per cents.," can cry—*Vae victis*,—starved be the vanquished!

The above considerations have, we think, been too much neglected in the discussions which the press has set up respecting the present labour dispute. A former article of ours will have been sufficient to show that we are far from sympathizing with the despotic tendencies of trades' unions, and other like associations. At the same time we should grieve to have it thought that we are insensible to facts of an opposite complexion; for we are fairly persuaded that no good can come from any advocacy in which either master or man is denied what is due to him.

THE WOOLWICH EXPERIMENTS ON CAST IRON.

A "BLUE BOOK" nearly two inches thick, consisting mainly of complicated tables, is not a pleasant thing to write upon; but such a book is the topic of the present article. We cannot hope, therefore, to make ourselves particularly agreeable in what we are about to say; at the same time we hope, by aid of the Report before us, to make ourselves instructive.

On the 5th of June, 1856, Lieut.-Colonel F. Eardley-Wilmot, superintendent of our Royal gun factories, wrote to the Right Hon. W. Monsell, M.P., Under Secretary of State for War, as follows:—"I beg," he said, "to call "attention to the desirableness of enlarging the "series of experiments as to the best quality of "iron for cannon. The question is one of great "importance as regards the public service, and "the improvement of an important branch of "British industry. A true and valuable result "can only be arrived at by the possession of "satisfactory data; we are now in a position to "make the necessary experiments. The cost of "procuring the sample of iron as proposed in "the accompanying advertisement, will be "small compared with the magnitude and value "of the results, in a national point of view. I "beg to suggest that the enclosed advertisement "be put in the public papers herein detailed, "and that the replies and communications be "forwarded to me when received. By this "means Her Majesty's Government will furnish "for their own use, and for the nation, a series "of data of the highest value and importance." The "advertisement" alluded to in this letter was published in the public prints on the 9th of June, 1856, and announced that the inquiries would comprise chemical analyses, specific gravity, tenacity, torsion, transverse strain, compressibility, impact, rending, and elasticity. Samples of not less than five cwt. of pig iron, with a small quantity of the fuel, flux, and ore employed, were to be sent in. A statement was also to accompany the samples, giving all particulars, and specifying that the sample of iron was of the first or second melting, as the case might be; also that the samples had been taken at random, and that similar iron can be produced in quantity. None that had been melted more than twice was to be received.

A great number of ironmasters responded to the invitation thus given, and a series of experiments, of an extensive and laborious character, was at once commenced, under the superintendence of Colonel Wilmot. The specimens have all been tested by Mr. M'Kinlay (the proof-master) and his assistants, who conducted the trials. They were roughly prepared in the factory, and accurately finished by Robert M'Kenzie; the specific gravities were taken by George Simm; and the necessary computations were by Robert Smith, computer. The subject is one of considerable interest and difficulty; and the publication of the results will, it is justly hoped, be followed by the careful examination of them "by many of those able men "whose writings on subjects of cast iron, and "the strength of materials generally, are well "known."

The term "cast iron," as describing any specific material, does not (we are told in the report) convey to the mind of those connected with such experiments any more positive quality than what may be gathered from the use of the term "wood" in speaking of that material. The remarkable range of the various qualities of different samples is scarcely more marked in the latter than in the former; and, in addition, the same iron treated in a different manner, as regards the apparently simple process of melting or cooling, assumes a different character. The general result of a considerable number of experiments made on this point is shown in the Table given in the foot-note below.* In the Woolwich experiments there has been no intention of ascertaining any data relative to the most suitable mixtures of various brands of iron, or of making experiments as to the treatment of any particular iron with reference to improving its quality; the object has been simply to ascertain which quality as purchasable in the market, or when specially supplied, is suitable for the particular purpose of making cannon. The iron has all, therefore, been treated in a precisely similar manner, and with few exceptions in the same furnace, which was kept free for the purpose. The pigs were broken, and where a variety of appearance was found turnings of each were mingled together and examined as a mean sample for analysis. And here we are at once met, as the Report very properly says, by questions which indicate the magnitude of this inquiry, if carried to its full extent. Does not almost every variety of iron require some treatment peculiar to itself? and, to effect an object with any particular iron, must there not be a definite dimension suitable to that iron? It is thought that it is so; and that in a gun, for instance, the form and dimensions offering the greatest strength with one iron, are not those best suited to another.

The results already obtained by various experiments on the subject of re-melting cast iron are well known, and have been repeated at various times in the works of the War Department; when, however, the experiment is made with large masses of iron of several tons, the effect produced is not so marked. It would appear, we are told, that without any considerable diminution of the impurities in the metal, as silicon, sulphur, and phosphorus, a considerable increase of tenacity and specific gravity can be obtained. The graphite is partially expelled, and some of it is converted into combined carbon, and the contraction and crystallisation is more energetic and complete. This combined carbon can, it is thought by some, on again re-melting the mass and very slowly cooling it, be re-converted to graphite, rendering the iron soft and fusible. This is undoubtedly the case with the product of the refinery process known as "metal," the use of which, on this principle, formed the subject of a patent, by Dr. Price, in 1856.

There is a point not, probably, accurately determined, at which the maximum hardness corresponding to the maximum tenacity may be found. In an iron cannon there is, however, required an elasticity in addition to other qualities, when these qualities are not in excess to such an extraordinary degree as to render the mass so strong and rigid as to obviate any danger of disruption. It has been found in the various experiments made at Woolwich, that in most cases where the specific gravity is 7·3 or upwards, the metal is unsuited to gun purposes, on account of its hardness and want of elasticity; while the same iron, treated in the furnace for a shorter time, and being when cast of a lower specific gravity and less tenacity, would have resisted more satisfactorily the explosion of the powder. "In the case of a cylin-"drical round bar 26 feet long and 7 inches "diameter, cast vertically, the following speci-"mens were taken. The mixture is similar to "that used at the time for making guns, and "was melted in a single furnace charged with "33 cwt. 2 qrs., and occupied 2 hours 15 "minutes in melting. Two discs in immediate "contact with one another, each furnishing two "tensile specimens, were cut off from the top, "the bottom, and the centre, *i.e.*, at intervals of "11 feet 11 inches asunder."

—	Tensile.	Specific gravity.	—	Tensile.	Specific gravity.
Top	29,382	7·251	Bottom	26,594	7·325
"	27,872		"	27,122	
"	31,266	7·183	"	29,085	7·323
"	30,587		"	30,589	
Centre ..	29,231	7·251	Combined Mean:		
" ...	26,218		Top	29,778	7·217
" ...	27,499	7·325	Centre	27,650	7·263
" ...	27,649		Bottom	28,618	7·321

The effect of the fluid pressure as regards the density of the metal is here sufficiently well marked; but the tenacity is not increased.

It would require a longer series of experiments than the Woolwich authorities have had time to institute, to establish accurately the relation between the amount of fluid pressure and the resulting tenacity and density. The result here given would appear to be in conformity with the opinion that increasing the length of the dead-head does not add to the resisting power of the metal when used for a gun, all that is required being to afford an ample allowance for feeding in shrinking, in consequence of the strength not being due to pressure or condensation, but to the contraction and crystallisation of the mass. In bronze or brass gun metal, the material being of a compressible character, a very decided result is obtained, as is shown in the following experiment upon specimens cut from the base, the muzzle, and the dead-head of a six-pounder brass gun, having about 30 inches in vertical depth between each:—

* TABLE showing the comparative qualities of Cast Iron; also the ratio of their strength (deduced from the general mean) as shown by the different tests.

—	Specific Gravity of 850 Specimens.	Tensile of 850 Specimens.	Transverse of 564 Specimens.	Torsion of 276 Specimens.	Crushing of 273 Specimens.
Maximum.....	7·343	34,279	11,321	9,773	140,056
	1/8	1/8	1/8	1/8	1/1
	T	T	T	T	T
Minimum	6·822	9,417	2,586	3,705	44,563
	Of 51 samples.	Of 51 samples.	Of 53 samples.	Of 51 samples.	Of 51 samples.
General mean	7·140	23,257	7,102	6,056	91,061
Ratio in terms of the	Tensile	1·000	·305	·260	3·915
	Transverse..	3·274	1·000	·852	12·821
	Torsion	3·840	1·172	1·000	15·053
	Crushing ...	·255	·078	·066	1·000

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—	Specific gravity.	Tensile.
		lbs.
Top	8·539	35,600
Centre	8·545	38,704
Bottom	8·814	49,401

The most decided features to be observed in the results obtained in the recent experiments are the universal and very marked superiority of the bars in the cases where they have been cast horizontally over those cast vertically; and the superiority, but in a less marked degree, of the bars cooled quickly over those cooled gradually or slowly. This is almost universally found to be the case in the experiments hitherto made with a portion of metal taken from the dead-head, close to the muzzle of the gun, as compared with the bar cast at the time of making the gun. The contrast as regards appearance is equally marked. In the bar, a close, grey, rigid appearance; in the dead-head, a large grain with graphitic masses joined or cemented together with a whiter and harder material.

Certain supplies of iron ordered in consequence of the results obtained in these experiments have, on examination, unfortunately given results differing much, both chemically and mechanically, showing superiority in some cases and inferiority of a marked character in others. The demand for the manufacture of iron ordnance, and "the necessity for the supply of a "certain number to meet what is expected in "this country of a new Government establish-"ment," has, we are significantly told, prevented such various experiments being made as are desirable. At a new Government foundry on the Continent, established about the same time, *two years* were allowed for experiments before a "supply" was demanded. It would appear that a great deal is still to be done on this subject, and that we are only now at the commencement of vast improvements in the manufacture of cast iron and cast steel. Some very fine results have been obtained from cast material prepared by Mr. Bessemer, which promise well; and, generally, the attention of those connected with the manufacture and use of iron is being directed to the subject.

It cannot be too strongly urged, says the Report, that the possession of a machine such as that in use in the Royal gun factories would greatly assist inquiries. A drawing of it is given in the United States "Reports of Experi-"ments on Metals for Cannon," Trübner & Co., Paternoster-row; and the use of it, with several additions, can be seen at the Arsenal. The manufacture of similar or improved machines, and the distribution of them through the country, would be attended with great results.

In the above remarks we have, as will be observed, had to draw largely upon the official Report, and even with the aid of this we must still leave much unsaid respecting the results of these elaborate experiments. For the deduction of information from those results we, like the Woolwich authorities, look to those "able men" before referred to. On another page, however, we have the satisfaction of printing a very able and interesting paper on the chemical results of the inquiry, from the pen of Mr. Abel, the accomplished chemist of the War Department.

THE PENNY PRESS AND THE NEW COINAGE.

THERE can be no doubt that the penny press of this country is effecting a vast amount of good. It is adding—imperceptibly, perhaps, but not the less certainly—to the general intelligence of the community at large. Politically, its articles—we refer more especially to the Metropolitan section of the cheap press—are written in an enlightened spirit, and where they may not be taken as infallible guides to the true doctrines of political economy, are at least suggestive and valuable aids to the study of that science. As promoters of sound moral sentiments—with, possibly, some occasional exceptions, the results of inadvertency—the penny newspapers of London may be pronounced faultless. As media, too, for introducing to classes of society who would never otherwise have the advantage conferred upon them, the opinions and the deductions of men of science, and with the records of discoveries and inventions resulting from their theories and their labours, there is much reason to be satisfied with them. Their published extracts from expensive and first-class publications, and their reports of the proceedings of learned societies, notes of whose doings would never otherwise extend beyond the immediate circle of *savans* in which they take place, are invaluable to the public; and on all these accounts and on many others we are pleased to be able to bear testimony to their value.

This general approval of the spirit and conduct of the penny press, which we unhesitatingly and conscientiously give, will guard us from having imputed to us hostile motives when we take the liberty of criticising unfavourably a particular article in the *Daily Telegraph*—we believe the oldest journal in the category. As the MECHANICS' MAGAZINE will be acknowledged to have been the first mover for a reformation of the inferior coinage of the realm, and as preparations are, according to Mr. Gladstone's recent statement in the House, being made to accomplish that reformation, it will be accorded to us to speak out when what we think fallacious views respecting the principles upon which the new coinage of bronze *vice* copper should be based. In the *Daily Telegraph* of Saturday last there appeared a leading article upon the projected change, wherein the writer, with pen more trenchant than just, hurls indignant epithets at the entire metallic currency of the kingdom and those who created it, and denounces the coining improvement as a cheat! "If the present idea be carried out"—that of issuing small coins of bronze—"the coinage "will be simply worth nothing at all. In fact, "it will be a mongrel metal, glittering and "worthless, like the civilisation it represents." These are harsh assertions. Are they borne out by reason or experience? We imagine by neither. We have explained before that ever since the year 1799, when the last coinage of what are called the "ring pence" of George III. were struck at Soho, the copper coinage of England has been completely on the token system. Ever since that period—with the exception of a coinage for Ireland of more reduced weight still—the pound avoirdupoise of copper has been coined into twenty-four pence, and the subordinate coins in the same proportions relatively to their value, namely, half-pence 48 to the 1 lb., and farthings 96. This makes a ton of coined copper worth in round numbers £224. Does the *Telegraph* writer require to be told that the average market price of "tile" copper, of which those coins have hitherto been manufactured, has not been over £100, and that consequently neither he nor any of his fellow-subjects, even though they may have had the satisfaction of having their pockets weighed down by the "clumsy "slabs of copper" of a former generation, ever possessed copper coins whose intrinsic value and weight were equal? The whole of the copper coinages of the last three reigns were therefore palpably tokens of value and nothing more; and we certainly should not expect to find a pair of scales and weights placed on the counter of the *Telegraph* office to test the pennies tendered in exchange for its valuable and broad sheets. A Victoria penny weighing two-thirds of an ounce is, we doubt not, as acceptable in exchange for a *Telegraph* as one of George III.'s "cart-wheel" pence, weighing one ounce. What becomes, then, of the charges of "inno-"vation" and "imposture," bandied freely in the article complained of?

Will it not be infinitely more convenient that three thousand tons of metal should—in the form of, we trust, beautiful coins—represent the six thousand tons of the "ugliest coins in "existence," which now circulate throughout the British Isles? Is there any reason why "slabs" of soft and nasty copper should be carried to and fro when neat, hard, and cleanly discs of bronze would answer every purpose and be infinitely more convenient? If in the one case a ton of copper, costing in the market say £100, is coined into £224 worth of pence, half-pence, or farthings, in the name of common sense we ask how will the public be losers by coining a ton of bronze whose value in the market is taken at £110, into £448 worth of coins? The profit on the coinage will be greater, we admit, but the Mint is a public institution, and the public must inevitably be gainers by the operation. If we were dealing with private manufacturers the case, of course, would be widely different, and the strictures of the *Daily Telegraph* would be justified. As it is, the inferior coinage of the realm is got up for public convenience at the public expense, and the problems to be solved in the renewal of it are, the best metal, the most portable forms, and the handsomest in appearance. The weight of the individual pieces is clearly a matter of indifference, and if they be made more economically and more durable than the "cart "wheel coinage" of George III., why so much the more advantageous for the people who in the shape of Civil Service Estimates must pay all the expenses attending their production.

Again, if our friend of the *Telegraph* were to induce the Chancellor of the Exchequer to adopt his plan of giving equal weight and value in the new coinage, what would be the consequence? and that, probably, before the coinage was a month old. Why, that a rise of £10 per ton in the market price of copper—and fluctuations wider are of constant occurrence—would consign the whole of the newly-minted money *sans ceremonie* into the furnace of the manufacturer—and we should all become in the "twinkling of an eye" literally penniless. But enough must have been said to convince our readers that this portion of the plan of the *Telegraph* writer would *never* answer. It is painful to be obliged to dissent also from almost all his other propositions.

For example, as touching the device to be imprinted on the forthcoming coins, we cannot think that in imitation of the ancient "Romans" we should give them impressions illustrative of the progress of our arms and of our great achievments in various quarters of the world. It would be difficult to convince us that "symbols of captured Lucknow and Delhi"—places whose names are better forgotten—of the "annihilation of Sebastopol, of the conquest of "Scinde and Pegu, of the colonisation of Aus-"tralasia, and a hundred other events," should figure on the new coins. We are rather disposed to think, on the contrary, that such a proceeding would lead to inextricable confusion, and open a door for the wholesale introduction of counterfeits. A uniform, chaste, and appropriate device, characteristic of the insular position and maritime greatness of the kingdom governed so well by our Queen, should, in our opinion, decorate one side of each piece of the new money, whilst the "image and superscrip-

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"tion" of Her Majesty should enrich the other.

As regards our friend's criticism of the present gold and silver coinages, there again we are at issue. We never saw "something meant, "we believe, to be a cross flinging about its "arms like the fans of a windmill on one side "of our silver pieces," although the writer of the *Telegraph* may. As to what the "mean and "pitiful" designs complained of may be we are equally in the dark. Of the engraving of the coins generally, although others may think it "abominably executed," the Wyons, whose work it is, may rest assured that there are those, whose opinions are worth having, too, who say that on the whole it is excellent.

The reckless remarks of the journal in question on this particular subject are so exceptional to the general care and truthfulness displayed in its articles, that we are *compelled* o notice the matter.

WHERE WILL THE BRONZE BE COINED?

Upon further examination and reflection it seems to us that one of the very first questions relative to the new coinage which should be considered by the Chancellor of the Exchequer, is that of the capabilities, mechanical and otherwise, of the Mint. A tardy and gradual introduction of the bronze coins would produce a mischievous effect. Already there are innumerable representatives of copper tokens floating in the channels of circulation, and which pass current simply because they approach the *size* of the orthodox pence, halfpence, and farthings. To add to this "variety," which is the reverse of being "charming," by slowly and timidly commingling with them another set of specimens, would be but to increase the existing confusion. The reform adopted and to be carried out by the Government to be effectual must be rapid. Unlike political reforms, which are usually of very, *very* slow growth, this must be sharply and suddenly matured. There should be in the Mint stores a large accumulation of the miniature bronze pieces before any are issued to supplant the giant copper coins. A simultaneous publication of the one and withdrawal of the other might then be made without difficulty or annoyance. In London, and, by aid of railways, in all large towns of the kingdom, the exchange of bronze for copper might go on at once, and within a week millions of beautiful light coins would be jingling in the pockets of the people in lieu of the absurd "slabs" of metal which now weigh their pockets down and wear them out. It is evident, indeed, that a quick transformation must be effected. Mr. Gladstone cannot fail to perceive its necessity, and probably is adopting means for its accomplishment. But he must inquire primarily, one should think, into the productive powers of the Mint. At all events, we have done so, and our conclusion is, that they are at present inadequate to the "great occasion." For the manipulation of all the gold, silver, and inferior metal coins for England and many of the colonies the Mint possesses only six pairs of rolls, a dozen cutting-out or punching presses, thirteen of the Cotton-Napier weighing machines, and eight Soho stamping presses. Now, taking the maximum rate of production of these latter, as given in the Parliamentary blue-books by Mint authorities, at 240,000 coins per day, how long would it take to strike off five hundred millions? We need not stop to answer the question; it is clear that by devoting the whole resources of the money factory to the creation of the new money it would still be a work of many years. When it is known additionally, too, that the Bank of England is incessantly demanding gold and silver coin, and that from the fluctuations of the continental markets and other disturbing causes at home, much has frequently to be struck off in a short time, it becomes obvious that the Mint would be as unable to accomplish the work required of it as would the stage coaches running five-and-twenty years ago to convey the passengers of the railway trains of to-day. Doubtless this fact is patent to the Chancellor of the Exchequer, who is no unworthy disciple of "Cocker;" but how does the right hon. gentleman mean to remedy it?

A private manufacturer, whose business—were it the making of hats, or of money, or both—had outgrown his premises, would inevitably increase, if he could, his facilities for doing work. Surely the same course will suggest itself to the Treasury and the Mint people. Like other manufactories, the Tower-hill establishment served its purpose and met all its demands for many years, but, like them, it feels now the pressure of a new state of things, and it must be expanded so as to divide that pressure over a wider area. The Californian and Australian gold discoveries have, as the Mint returns to the House of Commons demonstrate, served to keep the stamping presses at work for a considerable part of the past nine years; and although the Sydney Mint relieves it to some extent now, yet that extent is barely appreciable. There are only two presses, we believe, at Sydney, and their production is small and exclusively colonial. Advancing commerce, increasing trade, widening speculation, and growing emigration, make it certain that more and more of coin with the British stamp upon it will be wanted. Why, then, is there any supineness in observing the "signs of the times," or in preparing for the duty to be done? Once the "Great Western" steam-ship was considered a marvel of ship-building and engineering skill, but what was she in comparison with the "Great Eastern," which will presently astonish our Transatlantic cousins? Progress in art, progress in science, progress in mechanical skill and mechanical devices, are the rule of the day, and why should Her Majesty's Mint prove an exception to the rule? Why should that numerous body of soldiers and policemen whom one sees "on duty" at the portals of the money factory appear to shut out from it mechanical improvement, and to roll back the tide of scientific invention? Is the area of ground inclosed by its boundary walls insufficient for the increased plant of machinery requisite to deal with the new coinage. If so, and the purchase of more property adjoining it is impossible, why then the sooner a migratory movement of the whole "concern" takes place the better. If the Mint as it stands is not capable of meeting the wants of the time, and is not large enough to receive from the engineering works of London or elsewhere the means and appliances which would make it so, why the sooner its site is made over to the dock company for a great warehouse the better. New machinery of improved character, and a building of larger dimensions, might soon be found for Her Majesty's coiners, and England might boast a national Mint competent to coin all the national monies. Seriously, it is not creditable that the demand for money should have outstripped the Mint's producing power—as our witness, the blue-book, proves it has—and it is urgent that Mr. Gladstone takes steps to mitigate the evil. Of course, it will be said, Well, there is private enterprise to fall back upon, and contractors at Birmingham or Manchester will be found ready, for a sufficient "consideration," to erect rollers, punches, and other machinery for carrying on the coiner's art and producing money at any speed. Yes, we are aware of that; the manufacturers of Birmingham especially are a go-a-head people, but that is not quite the thing. A little of the "go-a-head" principle *must* be instilled into the Government mind. Thirty thousand pounds, *vide* Civil Service Estimates, are voted annually for the expenses of the Mint, including coinage, and if, as we believe, without an augmentation of any but the dead stock—the mechanical plant—it can be made to do all the work of the country, there can be no use in calling in contractors' aid at all, and the reformation of the coinage should begin with a reformation of the Mint.

In 1810 the establishment was as efficient, speaking of machines, as it is in 1860. Half-a-century has not added to its stature, whilst all around it has grown to majestic proportions. Calcutta, we are told, will shortly be armed with twenty-four stamping presses—twelve of them being of much improved construction, and each capable of stamping twice as many coins per minute as those at the Mint. Why should the Indian outstrip and eclipse the Home Empire? Let our ministers look to this; it is of importance, and the national credit is involved. Either *no* contract work in coining, or *all* contract would seem to be right; but money-making being so delicate a matter, and in the hands of contractors so likely to lead to serious irregularities, it seems to us that it should be retained jealously in Government hands.

DECIMAL COINAGE.

We observe with much satisfaction that the "International Association for obtaining a "Uniform Decimal System of Measures, "Weights, and Coins," will hold their fourth general meeting at Bradford, on the 10th of October next. The noblemen and gentlemen comprising this society voted a resolution on the 28th November, 1855, to the effect that the "adoption of a uniform decimal system of "measures, weights, and coins would be conducive to the manufacturing and commercial "prosperity of the United Kingdom," and of many other benefits; and it must be permitted us to say that there is good ground for believing the resolution to be based on truth. The indefatigability with which the members of the Association have devoted themselves, at home and abroad, to the investigation of this important subject makes it certain that the Bradford meeting will be of great interest. We shall have the opinion of scientific men of all countries upon the decimal system, whilst there can be no doubt that Lord Overstone's adverse report will receive some attention at the hands of men well qualified to detect any sophistries or fallacious arguments it may contain. The names of Richard Cobden, William Ewart, William Fairbairn, Esq., C.E., and the Right Hon. Thos. Milner Gibson, figure amongst others as members of the Council of the International Decimal Association; and with these sturdy champions to support the decimal plans of measurement, weight, and value, we think that some little wordy fighting must take place before those plans are abandoned. It will afford us sincere pleasure to observe the progress made by the Association, and to endeavour to obtain for it a fair hearing, and for its propositions due consideration.

The *Gazette des Chemins de Fer* announces that a new break for railway trains has been invented by a M. Rigolier. From trials made it appears that a carriage driven at the rate of 20 kilometres per hour did not run more than 10 metres after the break had been applied; and that at a speed of 65 kilometres per hour it only ran 30 metres. It was also found that a locomotive could not drag M. Rigolier's waggon when his break was applied to the wheels.

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THE GREAT EASTERN.

Sept. 7, Noon.

THE great ship having cast anchor off Purfleet (between Erith and Gravesend) we can do no better, we think, than gossip for a few minutes with our readers (for one can only gossip on shipboard) respecting the event which has kept both banks of the Thames thronged with cheering human creatures for several hours this morning.

It having been our good fortune to receive one of the very few invitations issued for this passage of the Great Eastern down the river, we embarked last night "by the light of the moon," and found that the ship really was to undertake the passage, weather permitting, early to-day. In both engine-rooms all was ready for the purpose; the last few barge-loads of stores were alongside, and were being rapidly run on board by the steam cranes; the coaling was completed, as far, that is, as it was intended to coal at Deptford; the rain and wind of the day had subsided; and the captain announced that nothing short of a gale would defer the departure of the morning.

Occasion was thus afforded for speculation upon the prospects we had of getting well down the river to-day, and this speculation we quietly pursued while pacing the "great deck" (in a very pleasant mixture of moonlight and starlight) till the hours grew nearly to their largest. As grounds for apprehension we had, first, the fact that several very awkward bends and shallows would present themselves almost as soon as our moorings were slipt; and secondly, we had the further fact that on the first trial of a stupendous experiment mischances and miscarriages of some kind may usually be looked for with confidence. We also knew that the engines of our ship were of an unprecedented size, and were really about to be put upon their trial for the first time. On the other hand we knew that in Mr. Atkinson we were to possess the skilfullest of pilots—in Captain Harrison the ablest of captains—and in the engineers on board some of the cleverest practical men of the day. We further had the satisfaction of learning that the working of both the paddle and the screw engines were to be placed under the personal control of Mr. Scott Russell, and of him alone. This last arrangement was calculated to inspire great confidence, because no one could possibly have a higher sense than Mr. Russell of the importance of handling the engines carefully on this great occasion, and no one could have a warmer interest in their successful operation. On the whole, therefore, we "turned in" contented with our anticipations of the morrow's work.

The result, thus far, has amply justified our expectations. By six o'clock this morning we were on deck, and found good reason to expect an early start. By half past seven the tugs had hold of us, the moorings were slipt, and amid many cheers the monster moved off. Without the slightest mishap, and almost without a stoppage, this huge structure has been brought in three hours to this spot, where she has room to swing with the tide, and make herself "at home," for the first time. From the moment of starting, all eyes have been turned upon the pilot, the captain, and Mr. Russell, the two former of whom have performed their duty from the paddle-boxes as usual, while Mr. Russell has kept himself stationed at the engine-room telegraphs, upon the paddle-bridge, working the two engines conjointly or separately, as seemed best to him—always, of course, supplying the speed required by the pilot. Neither engine has, however, run beyond very low velocities. Twenty revolutions per minute is, we believe, the greatest speed which the screw engine has been allowed to attain, and the paddle engine has been limited to about seven or eight. It is no part of the proprietors' present purpose to attempt anything like a trial of speed. The first thing is to get the ship safely out of the Thames; the next will be to get her comfortably round to Portland. After that she will start upon her "trial trip," and then will be the time for putting her to all necessary tests.

The experiment of to-day has sufficiently shown that the practical handling of ships of this immense size will present no great difficulties. Careful observation has enabled us to assure ourselves that, at low speeds, at any rate, the Great Eastern will steer well. Whether a high speed will interfere with her excellence in this respect can hardly be said; let us hope not. Then, as to the communication of the captain's instructions along her great length, very little difficulty has been experienced, notwithstanding the intricacy of the navigation in this instance; indeed, the only difficulty that occurred was that of getting the tugs a-head to do exactly what was required in all cases; no obstruction whatever interfered with the guidance of the helmsmen. Nor is this owing to the adoption of Mr. Lungley's admirable steering-signal apparatus, for through an error in the arrangement of one of the parts this will not be placed at the captain's service until to-morrow. The apparatus will, however, reduce this part of the vessel's management to the simplest form possible; for by it the captain will be able to speak to the eye of the helmsman—no matter how far off he may be—all but as quickly and distinctly as he could speak to his ear when at his side. We hope to see the apparatus in operation on our way to the Nore to-morrow.

We must not omit to mention the admirable precision with which Mr. Suffield's engine-room telegraphs have worked to-day. We have made them the objects of our special observation, and must say that their operation has been most satisfactory. In addition to our own testimony we may also add that of Mr. Scott Russell, who, as we have already said, worked them himself throughout, and who has subsequently assured Mr. Suffield that they have given him entire satisfaction; have proved themselves, in a word, "reliable."

To-morrow, the weather being moderate, we proceed to the Nore. We shall there, probably, have another opportunity of reporting progress, but not, we fear, in time for our next number. The ship, and all in whose hands she now is, deserve success, and we sincerely wish it them.

Thursday Noon, Off Southend.

We are now running down to the Nore under engines at "half-speed," the paddles making 8½ revolutions, and the screw 28. The theoretical speed of the ship (neglecting slips) is therefore about 13 knots; the real speed is 2 or 3 knots less probably, as the screw and wheels are insufficiently immersed to produce any near approximation to the theoretical result. The crew and company have saluted the ship, giving also three cheers, and one cheer more for Mr. Scott Russell and also for Mr. Brunel. All on board are delighted with the complete success that has thus far attended the ship's progress.

[We have at the last moment received another communication from our colleague (dated from Sheerness), stating that the ship ran down Long Reach most handsomely after the tugs were cast off. There is scarcely any perceptible vibration produced in the ship, except near the stern, and even there it is but very slight. She will have started for Portland before these lines appear.]

The following table, giving the theoretical speeds of both the paddles and the screw, graduated according to the number of revolutions made in each case, will be interesting. Experiments made this morning show that these theoretical numbers may be taken as practically correct, the slips in the two cases balancing each other:—

PADDLE. Rev.	Knots.	SCREW. Rev.	Knots.
¼	0·41	1	0·43
½	0·82	2	0·86
¾	1·23	3	1·30
1	1·64	4	1·73
1¼	2·05	5	2·17
1½	2·46	6	2·60
1¾	2·87	7	3·03
2	3·28	8	3·47
2¼	3·69	9	3·90
2½	4·10		
2¾	4·51	10	4·34
3	4·92	11	4·77
3¼	5·33	12	5·20
3½	5·74	13	5·64
3¾	6·15	14	6·07
4	6·56	15	6·51
4¼	6·97	16	6·94
4½	7·38	17	7·37
4¾	7·80	18	7·81
5	8·21	19	8·24
5¼	8·62	20	8·63
5½	9·03	21	9·11
5¾	9·44	22	9·54
6	9·85	23	9·93
6¼	10·26	24	10·41
6½	10·67	25	10·85
6¾	11·08	23	11·28
7	11·49		
7¼	11·90	27	11·71
7½	12·31	28	12·15
7¾	12·72	29	12·58
8	13·13	30	13·02
8¼	13·54	31	13·45
8½	13·95	32	13·88
8¾	14·37	33	14·32
9	14·78	34	14·75
9¼	15·19	35	15·19
9½	15·60	36	15·62
9¾	16·01	37	16·05
10	16·43	38	16·49
10¼	16·83	39	16·92
10½	17·24	40	17·36
10¾	17·65	41	17·79
11	18·06	42	18·22
11¼	18·47	43	18·63
11½	18·88	44	19·09
11¾	19·29		
12	19·70	45	19·53
12¼	20·11	46	19·96
12½	20·52	47	20·39
12¾	20·93	48	20·83
13	21·35	49	21·26
13¼	21·76	50	21·70
13½	22·17	51	22·13
13¾	22·58	52	22·56
14	22·99	53	23·00

THE CHEMISTRY OF CAST-IRON.

By F. A. ABEL, Esq., Chemist of the War Department.

THE following paper on the "Results of the chemical examination of iron, and the materials employed in its production," is taken from the blue-book on cast-iron which has just been issued, and which is discussed in a leading article on another page of this Number.

A special report has been drawn up on the result of the analytical examinations of each set of samples received from the various works. To facilitate a comparison between the composition of the irons, ores, &c., tabulated statements have been prepared of the following description:—

Table I. embraces the numerical results obtained in the examination of the samples of iron.

Table II. exhibits the per-centages of the most important constituents of the various ores; and,

Table III. includes, similarly, the principal results obtained in the examination of the fuels and fluxes.

The following are a few remarks which have suggested themselves upon an inspection of these tabulated results:—

The specimens of iron prepared from the ores of the Northern District and from the Forest of Dean are remarkably free from phosphorus. This is readily explained by the very high quality of these ores, which are almost perfectly free from phosphoric acid. The considerable per-centage of silicon contained in a great number of the specimens of iron alluded to is perhaps less easy of

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explanation. A reference to the composition of the specimen of Ulverston (Hæmatite) iron, given in the appendix to this Report, which was smelted with charcoal, and only contains 0·59 per cent. of silicon, would appear, however, to indicate definitely that the high proportions of silicon must be ascribed to the employment of hot-blast in the reduction of the iron at those works.

The products of the ores from South Staffordshire and South Wales which have been examined are, with two or three exceptions, of excellent chemical quality. Only three instances occur in these divisions of the series of iron samples (out of twenty-six samples from eight different works), in which the amount of silicon reaches two per cent. The samples from the Netherton and Old Hill Works (South Staffordshire) and the Blaenavon and Pontypool Works (South Wales), in the preparation of which cold-blast is specified as having been employed, the silicon, in only two instances (out of thirteen varieties of iron), slightly exceeds in amount 1 15 per cent.

The proportions of phosphorus and sulphur in irons from the ores of these districts are also inconsiderable in the majority of the samples examined. In the case of three only (out of twenty-six) does the amount of sulphur reach to 1-10th per cent., and the phosphorus amounts to less than 0·5 per cent. in twenty instances; of the other six, three contain less than 0·6 per cent.; one from the Old Hill Works contains 0·63 per cent., and two samples from Brierly Hill Works contain 0·63 and 0·72 per cent. The ores employed at the latter works contain somewhat high per-centages of phosphoric acid, the effects of which on the composition of the iron produced are, therefore, clearly traced. The per-centages of phosphoric acid in the ores used at the Old Hill Works (particularly in the "Balls," Bilston), are also higher than those in most of the ores used at the remaining South Staffordshire Works; and its influence on the quality of the product is, to some extent, shown by a reference to the composition of some of the irons from those works.

That the proportion of phosphorus in the iron is not always determined by the proportion of phosphoric acid existing in the ore employed need, however, be scarcely pointed out; the fact may be exemplified by reference to some of the samples of iron from the works last alluded to, and to the iron from the Lays Works, near Dudley, in which the per-centage of phosphorus is small, while the phosphoric acid in the ore is comparatively high. The circumstance that the proportion of phosphorus in all the samples of iron from the Blaenavon Works is small, while several of the ores employed contain considerable quantities of phosphoric acid, is probably to be ascribed to the employment of cold blast in the reduction of the iron at those works.

The Oolitic ores and the clay ironstones employed at the works in the North Midland and North Staffordshire districts, from which specimens were submitted, as also the ochrey brown ironstones employed at the Northamptonshire Works, contain proportions of phosphoric acid, which are more considerable than those existing in the greater number of the other ores examined. Thus, the ore employed at the South Bank Furnaces contains nearly two per cent. of phosphoric acid; that used at the Stockton Works contains upwards of 1·5 per cent., and very nearly the same amount exists in one of the ores at the Butterley Works, and in that employed at the Goldendale Works (North Staffordshire). The proportions of phosphorus in the various samples of iron from these sources exceed one per cent., excepting in one sample from the Butterley Works, in which, however, it amounts to 0·72 per cent.

The samples of iron produced from Northamptonshire ores also contain more than one per cent. of phosphorus, the proportions of phosphoric acid in the ores are, however, not quite as high as those last alluded to, amounting to 0·84 and 1·03 per cent. The samples of iron from one of the works (the East End Iron Works) are, moreover, stated to have been produced with cold blast.

The North Staffordshire ore, used at the Goldendale Works, contains nearly 1·5 per cent. of phosphoric acid, and the proportion of phosphorus in the iron produced from it just exceeds one per cent.

A general inspection of the results obtained in the examination of the samples of ores and of the iron varieties produced from them appears to justify the following conclusions, upon which metallurgic chemists are now tolerably well agreed:—

1. The proportion of silicon in iron is much less influenced by the constitution or quality of the ores employed than by the conditions of smelting. A reference to the composition of the Northamptonshire ores and iron samples (particularly those from the Heyford Works), indicates that under certain circumstances, among which may probably be included a deficiency in alumina in the ore or the flux employed, an ore containing much silica is very liable to furnish a highly siliceous iron.

2. The proportion of sulphur existing even in light grey pig-iron is never so considerable as to exert an appreciable influence on the properties of the metal; and none of the descriptions of British ores which have been examined in connection with this report contain an amount of sulphur compound sufficient to exert any prejudicial influence on the quality of iron produced from them.

3. The proportion of phosphorus in iron is, in great measure, determined by the per-centage of phosphoric acid in the ore employed, while, at the same time, it is probably to some extent regulated by the temperature at which the reduction is effected (*i. e.*, by the employment of hot or cold blast).

The various ores examined, if classed according to the per-centage of phosphorus in the iron reduced from them, would stand in the following order:—

No. 1. Northern District and Forest of Dean ores, used by the Whitehaven, Weardale, and Parkend Works.

No. 2. South Staffordshire ores, used at the Netherton, Parkhead, Old Hill, Lays and Level Works.

South Wales ores, used at the Ystalyfera Works.

South Wales ores, smelted with cold blast at the Blaenavon and Pontypool Works.

No. 3. North Midland ores, used at the West Hallam Works.

No. 4. Northamptonshire ores, used at the East End and Heyford Works.

North Staffordshire ore, used at the Goldendale Works.

North Midland ores, used at the Butterley Works.

No. 5. Cleveland ores, used at the South Bank and Stockton Works.

It will scarcely be out of place to conclude these few remarks on the results of the analytical examinations, with some notice of the very considerable difference observed in the structure of many of the samples of iron analysed, and particularly in the physical condition of the so-called graphite, as exhibited by fresh fractures of the metal. In some instances a grey iron containing a per-centage of graphite similar to, or even higher than, that in a second example, exhibited a dense compact structure, while that of the other sample was open-grained, and showed the existence of the graphite in large and distinct scales. These modifications in the structure of pig-iron are so well known, that they are only alluded to because it is to them that must undoubtedly be ascribed, in many instances, the apparent discrepancies (which may be noticed by a comparison of the results included in this report) between the chemical quality of a sample of iron and the results which it has furnished when submitted to mechanical tests. It is self-evident that a sample of grey iron, compact and uniform in structure, may resist the application, for example, of a much more considerable tensile strain, than one which is of higher chemical quality (*e. g.*, containing less silicon or phosphorus), but of which the structure is comparatively open and irregular. There is little doubt, also, from the results of numerous experiments which have been made in this direction, that the effect of adding considerably to the strength of some kinds of cast-iron, by repeatedly re-melting them, is, within certain limits, due to no important chemical change effected in the iron, but to the gradual production of a more thoroughly uniform mass, in which the graphite carbon has gradually undergone a material change in its state of aggregation.

CAPTAIN BLAKELY ON THE ARMSTRONG GUN.

THE following letter claiming a royalty on every Armstrong Gun that is made has been addressed to the Secretary of State for War by Captain Blakely, H.P. Royal Artillery:—

SIR,—The late Secretary of State for War having left undecided a case of great importance to me, and the correspondence on the subject being voluminous, I have the honour now to lay before you in a simple form the principal facts.

In 1854 I discovered a method of constructing cannon (or other tubes) whereby greater strength can be obtained from the same thickness of the same metal than by any other known method; in September I offered to the Duke of Newcastle to communicate my plan to any person his Grace wished, who was capable of understanding the subject, but was referred to the Ordnance Select Committee; in November I went, at considerable expense, to Constantinople and Balaclava, and tried in vain to persuade Lord Lyons to use my invention for some heavy guns to destroy the sea-forts of Sevastopol, and for some huge howitzers to shell that place from steamers at a distance of two or three miles. On my return to England in January, 1855, you may recollect, Sir, that you were good enough to give me a note of introduction to the Duke of Newcastle, who then immediately received me, and put me in communication with Colonel Lefroy on the subject. From this scientific officer, however, I learnt with much regret, that he personally could do nothing to recommend my plans or the reverse, but that they must be laid before the Ordnance Select Committee. Knowing the uselessness of approaching that body* with a novel invention, the only proof of whose utility rested on mathematical calculations, I at once set to work to get a sample gun made. Having already been at expense in going to the East, and being about to enter on a course of costly experiments, I now took out a patent (dated the 27th February, 1855). Before attempting thus to ensure any profit to myself, you will perceive, Sir, that I had offered my invention to the country as a free gift, and given myself much trouble to press its acceptance on it. I was extremely fortunate in my choice of a manufacturer, and by the end of March the Butterley Company had completed for me an 18-pounder gun, which was tested near their works in Derbyshire, and whose strength exceeded my expectations. I applied to Lord Panmure for leave to have it tested at Woolwich by the Ordnance Select Committee, but as a communication between the War Office and the Committee, through the Lieutenant General of Artillery, required six or seven weeks, I had the gun altered for further private experiments. It was an excellent 18-pounder gun, fully equal to the service gun, though little more than one-third its weight: I had the bore enlarged to the size of a 24-pounder, reducing the thickness of metal where the greatest strength is requisite to 2¼ inches. As the thickness of an ordinary 24-pounder is there 6¼ inches, I can have had no expectation that mine would be equally strong. I only wished to see how strong it was. Having by the middle of May obtained permission to send the gun to Woolwich, I did so, and explained to

* The Committee of 1854 was differently constituted from the present one.

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the Committee how I had altered and weakened it. It was tried, and after being fired several rounds with 4 lbs., 5 lbs. and 6 lbs. of powder, a solid 24-pounder shot, and two wads, it absolutely twice bore a charge of 8 lbs. of powder and the shot and wads, bursting at the third round. To my astonishment, the Committee reported that "guns so constructed could never be considered safe."

Some scientific members having been added to the Committee by the Duke of Newcastle, and having been invited by the President to sit (in consequence of representations, which have secured me the hostility of the Committee ever since), I early in June presented the calculations on which I formed my theory, and obtained leave to send another gun for trial. The calculations were reported on by a mathematician, Mr. Heather, and declared inapplicable to cannon. The gun, however, a 9-pounder, was most completely successful. A cast-iron service gun and a brass service gun of the same calibre were fired round for round with it, with the same charge of powder, so long as they stood. All three were fired :—

2	rounds with	8 lbs.	of powder,	2	shots and	1 wad.
80	„	3 lbs.	„	1	„	1 „
26	„	4 lbs.	„	1	„	1 „
5	„	5 lbs.	„	1	„	1 „
5	„	5 lbs.	„	2	„	1 „
110	„	6 lbs.	„	2	„	1 „

Here the cast-iron service gun burst. The other two were then fired :—

71 rounds with 6 lbs of powder, 2 shots and 1 wad.

Here the brass gun became unserviceable from loss of chase, mine alone remaining, and being fired afterwards :—

134	rounds with	6 lbs.	of powder,	2	shots and	1 wad.
1	„	6 lbs.	„	3	„	1 „
1	„	6 lbs.	„	4	„	1 „
1	„	6 lbs.	„	5	„	1 „
1	„	6 lbs.	„	6	„	1 „
1	„	6 lbs.	„	7	„	1 „
1	„	6 lbs.	„	8	„	1 „
1	„	6 lbs.	„	9	„	1 „
158	„	6 lbs.	„ and filled to the muzzle!			

So great was the endurance of this gun, that the experiment lasted nineteen months, consequently was not officially reported till 1857. A 68-pounder was then ordered to be made at the Government foundry at Woolwich, further to test my plan. The gun has been made, but, I believe, has not been fired to this day!! Meanwhile I have made many private experiments.

In 1855, Mr. Robert Mallet, assisted by an eminent mathematician, Dr. Andrew Hart, of Trinity College, Dublin, planned the construction of cannon on the same principle I advocate. He obtained the sanction of Lord Palmerston to expend a large sum of public money to test the truth of the theory; the Ordnance Select Committee having reported it unsound. I could bring forward, if necessary, many more proofs that the value of this method of manufacture was unknown at the commencement of the year 1855, at least to the British Government and all their official advisers; but those I have here stated will, I trust, Sir, remove all doubt on that subject from your mind: the Ordnance Select Committee reported that "guns so constructed could never be considered safe," and even after witnessing the wonderful endurance of two guns, desired to see further experiments. *They* cannot pretend to have known the value of the method before! Nor can Lord Palmerston's Government, as that statesman sanctioned Mr. Mallet's spending thousands to test it.* Nor can any of those who have sanctioned the manufacture of 3,000 or 4,000 guns within the last three years on the old plan.

This being the case, and I have spent upwards of £1,500 in experiments and in urging the Government to use my method, I have no hesitation in asking you, Sir, now that it is adopted, to cause to be paid to me a suitable royalty on each gun manufactured according to my patent either in the Royal Arsenal at Woolwich, or by private contractors for the use of the Government, or else to purchase my patent. The cannon on which I claim a royalty are now known as Armstrong guns, but their strength is obtained by the plan I advocate, as you will at once perceive, Sir, by comparing the published accounts of each.

Provisional Specification left by W. G. Armstrong at the Office of the Commissioners of Patents, with his Petition, on the 11th Feb., 1857.

"I, WILLIAM GEORGE ARMSTRONG, of Newcastle-upon-Tyne, in the County of Northumberland, Civil Engineer, do hereby declare the nature of the said Invention for 'Improvements in Ordnance,' to be as follows :—

"The improvements relate, firstly, to forming guns with the internal tube or cylinder of wrought iron or gun metal in one piece, surrounded by one or more cylindrical castings of wrought iron or gun metal shrunk upon the internal cylinder," &c.

In the MECHANICS' MAGAZINE, of Feb. 25th, it is said that the Armstrong gun

"Is formed of an internal steel tube, bound over with strips of rolled iron laid on spirally."

Provisional Specification left by A. T. Blakely at the Office of the Commissioners of Patents, with his Petition, on the 27th of February, 1855.

"I, ALEXANDER THEOPHILUS BLAKELY, of Little Ryder Street, St. James's, in the County of Middlesex, Captain of the Royal Artillery, do hereby declare the nature of the said Invention for 'Improvements in Ordnance,' to be as follows :—

"The improvements relate, first, to forming guns with an internal tube or cylinder of cast iron or steel, enclosed with a casing of wrought iron or steel. I prefer to form the outer surface of the inner tube somewhat conical, the greatest diameter being just in front of the trunnions and tapering both ways, and to apply the outer casing in the form of collars or rings driven thereon; and in some cases I apply two or more layers of such rings, according to the strength sought to be obtained, the trunnions being of one piece with one of the rings. I also form such outer casing of wire or rod wound spirally in one or more layers around the inner cylinder or tube," &c.

(Here other extracts from Captain Younghusband's paper* the *Times*, the *Daily News*, and other journals follow.)

Of these extracts I would wish, Sir, to draw your especial attention to that from Captain Younghusband's report,—"*the parts are then in that state of initial tension which is necessary*;" and to that from my own description,—"*by forcing on the rings the necessary degree of tension can be obtained*;" because this tension is the essential and novel feature; and the similarity of expression is striking. If the necessity for this tension was known before to any one, and cannon were publicly constructed accordingly, my case is not good (though even could that be proved I fancy I have some claim on Government, having spent a large sum of money to prove this necessity to them, *they denying it*), as the words of Her Majesty's patent to me declare it void "if the said invention is not a new invention as to the *Public Use and Exercise* thereof in our United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man." Sir W. Armstrong's own letter is, I presume, conclusive, that his first cannon was made on my patented plan; "the gun," he says, "is composed internally of steel, and externally of wrought iron, applied in a twisted or spiral form." I am informed that now he makes the inside of wrought iron, thinking thereby to evade the words of my patent, while retaining the only essential feature of it, viz: the tension on the outer part. This might do for a private individual, but I feel certain Her Majesty's Government, so long as you, Sir, are Secretary of State for War, will never sanction such an evasion. Even were it fair, or even legal, it would be most prejudicial to Her Majesty's service to substitute an inferior metal for the inside of the gun, merely to save the trifling royalty due to me. That wrought iron is inferior is acknowledged by Sir W. Armstrong himself. He tried it, Captain Younghusband says, and abandoned it for steel. That he did not afterwards abandon steel, because it failed, is proved by his concluding words when writing to the *Times* about his first gun, which was made with a steel core :—

"It now only remains to be stated, that the course of the long series of experiments made with this gun it has been fired nearly 1,300 times without sustaining any permanent injury either in the breech-loading arrangement or otherwise. The only parts exposed to wear (and none are seriously so) are separable from the gun, and can with great facility be renewed."

On this point Captain Younghusband's evidence is still more decisive. After describing numerous experiments made at Shoeburyness with the gun, he tells us that—

"Mr. Armstrong, believing the gun to be stronger than necessary, suggested its being returned to him to have it re-bored for a heavier projectile."

Why then did Mr. Armstrong in the later guns use wrought iron? Evidently to attempt to evade my patent. On the publication of his letter in the *Times* of January 3rd, 1857, I sent it and my specification to a lawyer, and asked him if my patent included the method described in the letter. His reply was that it did, and that, without my permission, Sir William could not continue to manufacture his guns. I wrote to inform Sir W. Armstrong, and obtained a reply promising to "negociate" with me before "using" the invention "commercially." This promise was written on the 21st of January, 1857, yet on the 11th of February, three weeks later only, Sir William filed a provisional specification substituting wrought iron for the steel and cast iron mentioned in my patent! In November, 1856, I had the pleasure of seeing Sir Wm. Armstrong at his Engine Works, near Newcastle. On that occasion he expressed views exactly coinciding with my own, published nearly two years before, and distinctly told me that the *principle* of the construction of his cannon was to have the exterior in a state of permanent strain, and that it mattered little which of several suitable metals were used. He then agreed to manufacture a gun for me on my plans in which the above-named principle was to be applied by forcing a small tube into a cast iron larger one, the latter forming nearly the entire gun. He afterwards declined making it.

I am advised by eminent lawyers that neither this nor any other unimportant alteration would enable him legally to use the essential feature of my patent. I was prepared to try the question this summer by an action against the Elswick Company, but was stopped by a declaration by General Peel that if I continued it, he would cease to consider the question of the infringement of my patent rights in Woolwich Arsenal, or at least to correspond with me on the subject.

In choosing whether I would submit my case to the decision of a legal tribunal, where any quibble might have deprived me of my rights, or to that of an English statesman and gentleman, I could not hesitate. I made a discovery of great value to my country; I offered it to the country, and urged its acceptance; to enable me to raise money to prove its value, which after being denied for four years has now been acknowledged, and my plans adopted, not only as better than the old system, but as the only known method whereby sufficient strength can be obtained for rifle cannon of any size. This has been proved by the bursting of the 32-pounder and 68-pounder guns rifled by Mr. Whitworth, and by that gentleman immediately adopting my plan for those guns he is now making.

It remains for you, Sir, to decide what the country shall do for me; I can thank my God that He has enabled me to do my duty to it.

I have the honour to, Sir,
Your obedient servant,
A. T. BLAKELY.

The Right Honourable The Secretary of State for War, &c., &c., &c.

* I published, in the MECHANICS' MAGAZINE, my reasons for believing Mr. Mallet's mortars would fail, *before* they were tried. He had underrated the strength required.

* See MECHANICS' MAGAZINE for April 22, 1859, p. 24.

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THE NEW BRONZE COINAGE.

A CORRESPONDENT of the *Times* writes as follows:—A very sensible article, extracted from the MECHANICS' MAGAZINE, has been inserted in several of the daily papers on the above highly important subject, and I respectfully beg a small space in your columns, while I, as a practical engraver of some experience, endeavour to answer it. I shall feel too glad that if by your kind insertion of the opinion of one of the profession it should succeed in inciting others with more ability to supply my defects in striving to vindicate the national ability of the engravers, designers, and modellers of the present age. I will first glance at the highly commendable and honourable desire for improvement that has lately been shown in all our late national undertakings in connection with the fine arts, viz., by means of a public and general competition, judging the relative merits and capabilities alike of the highest and lowest engaged in the work required, and I ask you, Sir, the editor of the leading public journal, and the public generally, if it has not been of the greatest advantage to the country; therefore, why should not the same course be followed in the present instance? I have such perfect faith in the versatility of genius of our native artists that I have no hesitation whatever in saying they will relieve our Lady Emblem from the uncomfortable position she has occupied for so many years. The questions raised are:—

What impressions are to be given to the new bronze coins, and why not have something new? To this I answer there is indeed a vast field open for improvement.

Again, is there so much poverty of inventive skill among engravers that there is danger of getting something worse than the present impression?

I here assert that if the means of publicly and generally testing the question be allowed, there will be found plenty of native artists capable of making and executing a better design. To the last question, Is there no one in the kingdom who has talent enough to sketch out a design which would at once be symbolical of the ocean's sovereignty of Great Britain, and a fit impression for its coinage? I finally reply, let the opportunity be given of trying the fact, and proof would be shown that our countrymen have not degenerated, but will be found in numbers, ready, willing, and competent to execute a design that shall at once be a fit emblem to represent the coinage of the first country in the universe as it will the artistic skill of its people. Let me entreat, Sir, your powerful and generous advocacy in aid of the following proposition, should no better be found:—

1. That there be a public competitive exhibition of pencil or sepia drawings and wax or plaster models, about six inches in diameter.

2. That the exhibition he holden within this present month.

3. That artists of every grade be invited to compete.

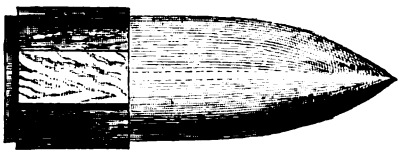
4. That the judges appointed shall choose a design from the drawings or models exhibited, and if their choice of design should not be the work of a practical engraver or artist, capable of carrying out the design, let a given sum be paid to him for the drawing or model chosen, and then give the commission to the best practical exhibitor for execution.

5. That the judges appointed be unconnected in any way with any of the exhibitors.

It is reported in Toulon that orders have been received from the French Admiralty to cease disarming the fleet, and that the forts commanding the entrance to the harbour are being armed with the guns which have hitherto been kept in store.

One of the Armstrong guns, an 80-pounder, forged at the Elswick factory, was recently tested in the long range at Shoeburyness, in the presence of the Ordnance Select Committee at Woolwich Arsenal, and gave the most wonderful results as regards accuracy, &c. The flight obtained was 9,000 yards, or upwards of five miles.

ELONGATED POINTED RIFLE SHOT FOR VERTICAL FIRE.



"TO THE EDITORS OF THE MECHANICS' MAGAZINE."

GENTLEMEN,—In your Magazine of last Friday you were so kind as to give a drawing with a description of my elongated flat-faced iron or steel rifle bolt. I shall now be much obliged if you will be so good as to insert a drawing of my elongated pointed rifle shot. The four-grooved wooden jacket is cut out of a piece of seasoned willow wood, with a sharp rifle cutter corresponding with the bore of the rifle; a hole is drilled out the centre of the jacket, which is then placed in the rifle mould, and the molten lead is poured through the hole, thus forming the body of the shot and a leaden disk protecting the base of the wooden jacket. In the year 1851, when the Kaffir war was raging, and the letters of many officers from the scene of action stated that the Kaffirs sheltered themselves in the, to the British soldier, impenetrable jungle of thorny mimosa, in the midst of stony and rocky ground, where our horizontal fire of musketry could make no impression on them, I wrote to the editor of the *Naval and Military Gazette* suggesting that my elongated rifle-shot and percussed shells fired *vertically* might have the effect of driving the Kaffirs from their jungle strongholds. The editor inserted my letter, but with an observation of his own, that Carnot made experiments by firing vertically round bullets from mortars, howitzers, and carronades, but that in their fall they made but a slight impression on boards placed on the ground. Now, the nature of Carnot's round shot vertical experiments bore no analogy to my plan of firing vertically elongated rifle shot and percussion shells. My plan resembled the arrow shower, Carnot's that of a ball falling from a sling. Every archer knows how deeply an arrow falling vertically penetrates the ground, and that it requires some force to draw it out.

I am, yours obediently,

J. NORTON.

Rosherville, 5th September.

THE "NAVIES OF THE WORLD."

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I have not the slightest wish to enter into any dispute, nor to prolong this correspondence further than may be requisite for the statement of the following facts:—

1. With regard to the articles in the "Conversations Lexicon," which you say "was not printed in the *Times*, nor heard of in England until January"—this article originally appeared, I believe, last September, and had, as I observed, "made a great sensation throughout Europe" long before it was discussed in England. The translation of it given by me in the "Navies of the World," together with the greater portion of the critique thereon, was in type last November.

2. The list of the French navy was in type shortly after, as was also a large portion of the rest of the book, though it was not published in its present form till the 28th May.

3. The parliamentary papers you allude to I did not see till March. The information extracted from them, which is not furnished in the appendix, together with the comments upon Sir John Pakington's and the extracts from Sir Wm. Armstrong's speeches, together with various other subjects, were embodied with the matter already in type (and which had, of course, been "kept standing") just before the volume went to press.

4. The work you name, Mr. Isherwood's "Engineering Precedents for Steam Machinery," I do not remember ever to have heard of, nor did I ever see the quotations therefrom in your Magazine of the 18th February. There can, therefore, be no extracts from that book, nor from your columns, in my fifth chapter, the greater part of which, if I recollect rightly, was written a twelvemonth ago. I remain, Gentlemen,

Your obedient servant,

THE AUTHOR OF THE "NAVIES OF THE WORLD."

Bridgenorth, 5th Sept., 1859.

[The above letter calls for but very few remarks from us, since it offers no contradiction whatever to our comments of last week. We can assent to all four of Mr. Busk's "facts," and still leave the subject precisely as we then stated it. We regret, however, for Mr. Busk's sake, that he has not the candour to acknowledge plainly that our first estimate of the book was fairly formed. Seeing evidences of very recent composition in all the chapters, and finding them plentiful in many places, we concluded that the book was recently written, and every intelligent reader of it will do the same. From this conviction, we are quite content to let Mr. Busk's explanations have whatever weight may belong to them, notwithstanding the difficulty we ourselves have in accepting some of them. Take this 4th "fact" of the above letter, for example. Mr. Busk says he has never read either Mr. Isherwood's work or our quotations from it. How difficult it must be for us to believe this statement the reader will judge when we put two passages side by side, thus:—

Mr. Isherwood, as quoted in the MECHANICS' MAGAZINE for Feb. 18, 1859.

"The machinery of the gun-boats, though well made, and by the best builders, was constantly out of order. Both boilers and engines gave continual trouble; the first from the use of high pressure steam and water; the last from the high rotary velocity employed. In fact, the rotary speed of the engines was so great that it was impossible to keep them in order. During the hostilities at and around Canton, the English established a shop on shore at Hongkong for repairing; they also had, at the same place, the floating workshop, "Volcano," sent out from England, completely fitted up with tools and power for doing a large amount of casting, forging, and finishing; and both these establishments were kept constantly employed on the gun-boats, there being, out of about fifteen, usually a couple undergoing repair; in fact, the repairs upon them were enormous. For economy of fuel, durability and reliability as war vessels for constant use, the machinery of these gun-boats cannot be recommended, however well adapted to the momentary purpose for which they were constructed."

Mr. Busk's "Navies of the World," p. 146.

"Well made, however, as the machinery of these gun-boats was, and by the best makers, both engines and boilers are constantly getting out of order, owing no doubt, in a great measure, to the excessive velocity of the screw. The fifteen gun-boats employed in the late Chinese war constantly kept two large steam factories (one afloat and one ashore) at work in executing their repairs; therefore, until some more durable machinery can be devised, these vessels can hardly be considered available, except for temporary emergencies in hostile operations upon an enemy's coast."

Now, we ask any man of the slightest experience in literary matters to read the above extracts carefully, and then tell us if he finds it easy to believe that the writer of the second extract had never read the first, particularly when he remembers that Mr. Isherwood (as we said in February) "derived most of his information respecting our gun-boats from *personal examination* of those employed in the capture of Canton," he being in China at the time. But we do not wish to urge such objections further. Let those who have confidence in us do the best they can with Mr. Busk's statement; as for others, they may read the book for themselves, and then judge us harshly—if they can. EDS. M. M.]

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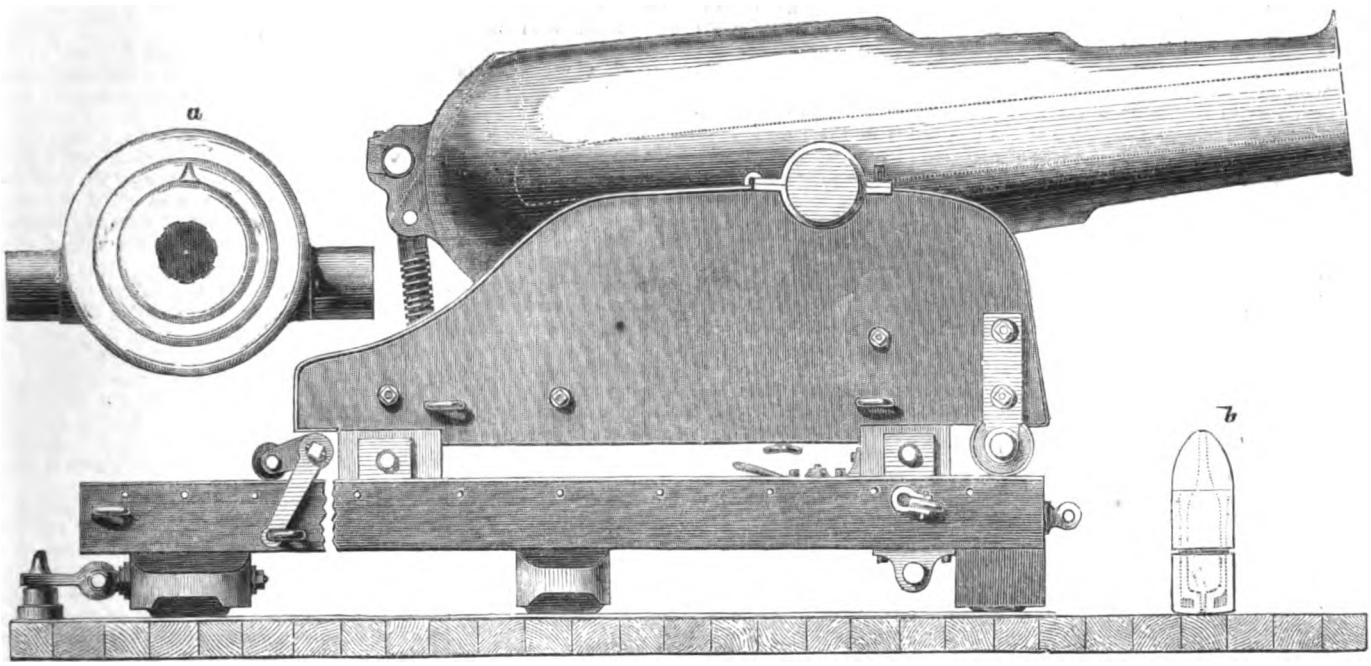
THOMAS'S HEAVY RIFLED CANNON FOR GUN-BOATS.



THOMAS'S HEAVY RIFLED CANNON FOR GUNBOATS.

THE author of the interesting paper on "Experiments in Gunnery" given in this number, in the volume from which that is taken proposes the use of the powerful rifled gun represented in side and front view in the annexed engraving. He says our own heavy guns are constructed upon a principle so false that the only wonder is that so few accidents happen with them; those of the largest size are not only unsafe, but also very inferior in power to the American guns. If, however, it should be discovered that rifled guns of six or eight tons weight—the weight of some of the guns employed in the American service—can be constructed of wrought iron, then, indeed, a powerful piece of ordnance will be obtained; a compound shell, of 2 cwt. and upwards, could be fired from it, and a greater range and accuracy combined would probably be attainable, than could be acquired with any other description of gun, such as could with convenience be used. A fortress or a floating battery, attacked with ordnance of this kind, could scarcely escape destruction. The length of the bore of the gun here illustrated is nine feet, and the calibre eight inches; the metal which surrounds the charge is nearly twelve inches in thickness; this (if the guns were constructed of the new puddled steel) would probably be sufficient to give it ample strength, and weight enough to prevent great recoil. A shell of 2 cwt., similar to that shown standing on end below the muzzle of the gun in the engraving, and a charge of from 25 lbs. to 30 lbs. of powder, might be used with it; *a* is the front view of the gun. "A long, low, strongly built vessel, possessing great steam power, armed with a gun of this kind, would prove," says Mr. Thomas, "infinitely more destructive than the steam battering-ram which has recently excited some attention. A vessel such as I have described would possess great advantage over a steam-ram, from the difficulty which would be experienced with the latter—first, in striking a vessel under sail or steaming; and secondly, in getting disengaged from it afterwards.

"Ten or twelve vessels of the above description—sea-going gun-boats—each armed with a heavy rifled gun to throw shells of 2 cwt., and with steam power sufficient to give them a speed of at least fourteen knots, would, at a distance of three miles,* lay any town on the coast in ashes, in a very short time, and with perfect impunity. This may be accomplished, and *will* be; if not by our own nation, by another. It is questionable, however, whether the 11 or 12 inch guns, such as form the armament of the American corvette, Niagara, would not prove more destructive in close action—from their large diameter and heavy bursting charges—than even the powerful rifled guns which I have described. Before adopting rifled guns into our naval service, to the entire exclusion of smooth-bored guns of large calibre, much consideration would be necessary, and many experiments required to be made. I see no reason, however, against the *acquisition* of such a gun as I have described. The only difficulties which lie in the way of it have already been once surmounted in the case of Messrs. Horsfall's 13-inch gun, and will, no doubt, be still more completely overcome. The great tensile strength which is required for guns to throw compound shells arises from the absence of windage, and also from the friction on the whole surface of the bore, which impedes the progress of the shell along the bore, and allows the fluid produced by the fired charge to accumulate behind the shell, and thus to exert a great strain on the gun. Nearly the maximum results as to range and general effect—regarding the means employed—might be attained with the gun represented in Plate 7. Any larger piece of ordnance would not only be unmanageable, but probably unsafe; and although a larger gun could, of course, throw a heavier projectile, still a *comparatively* greater effect could not be obtained with it, as the *range* of the larger shell would probably not be greater, unless a higher velocity could be given to it; so that, to acquire the same *relative* effect, comparatively greater means would have to be employed.

* At this range such a gun would not require an elevation of more than about 11°.

LIST OF NEW BOOKS.

Family Cyclopædia, The, 3s. 6d.
Moore's History of the British Ferns, 3 edition, 7s. 6d.
Needham's Physiology of Articulation, 3s. cl., 1s. swd.
Our Farm of Four Acres, 7 edition, 2s.
Parkinson's Under Government, Key to Civil Service, 3s. 6d.
Shot-Gun and Sporting Rifle, The, by Stonehenge, 10s. 6d.

ON EXPERIMENTS IN GUNNERY.

By LYNALL THOMAS Esq., F.R.S.L.

GUNNERY furnishes no exception to the rule, that there must be a cause for every effect; indeed, in scarcely any investigation is a knowledge of causes more essential than in conducting experiments in gunnery. Hence, when we find that two shots, fired apparently under precisely the same circumstances, show a variation in their range, or in their accuracy, we know that a cause must exist why this should be the case; and although the fact of the variation in the effect of shot fired under similar circumstances shows that *general* rules only are applicable in gunnery, and that no single result is to be relied on, yet a proper study of cause and effect in this matter will considerably reduce the chances of failure.*

It is not sufficient merely to obtain a greater range, accuracy, or general effect; but we should know, also, how these results are obtained, if we wish to profit by them in the greatest possible degree.

Before any new principle can be successfully applied in practice, repeated failures must always be expected. I may go so far as to assert that they are absolutely *necessary* to the complete attainment of success. Because the Lancaster, Whitworth, and other guns may have failed in fulfilling the expectations that were formed respecting them, their trial is, by no means on this account, to be considered as an entirely useless expenditure of either time or money. On the contrary, it was necessary that they should be made, and, no doubt, considerable advantage in many respects will arise from their having been made.

When men possessing mechanical skill in the highest degree—as Mr. Whitworth for instance—undertake experiments with a view to any improvement in the construction of implements, whether of a warlike or a peaceful character, good must always result; for, even if they fail in establishing their views, considerable light will always be thrown upon the subject to serve as a guide for the future. Still, although the aid of able mechanicians is of great importance in the

* These somewhat trite remarks were called forth by an observation which was made to the author by an artillery officer of some eminence—to the effect that "the firing of the charge with cannon was attended with such varying results, that it was useless to think of applying any rule for regulating the thickness, or strength of metal, required for guns of different calibres."

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practical application of the theory of rifled cannon and projectiles, the theory itself is, nevertheless, a philosophical rather than a mechanical question.

It will require systematic and well-conducted experiments, extending over a course of many years, before a sufficient knowledge can be acquired of all the circumstances attending the application of the principle of the rifle to cannon, to enable us to decide upon the best practical system for the construction either of the gun or the projectile. The different methods of applying the principle of the rifle to cannon—as, by having the gun to load at the breech, or the muzzle; or, having a compound, or a homogeneous projectile, will each have to be the subject of numerous experiments.

It is all the more imperative that these experiments should be undertaken by the Government, inasmuch as no person—so small is the knowledge which has as yet been generally acquired of this subject—is at present really competent to give an opinion upon anything new in connection with it which may be brought before their notice. I think I should not be far wrong in asserting that only a very few persons connected with the War Department are yet fully aware either of the comprehensive nature of the subject of rifled cannon, or of their want of knowledge in everything relating to it. To stand by and witness the trial, at Woolwich or Shoeburyness, of a number of projectiles, or a new gun—the result, in general, of private experiment—teaches little or nothing. Much more is learned by firing a single shot—made expressly for the purpose of ascertaining some particular effect—and by a thorough examination and careful study of all the circumstances attending its projection, than by merely witnessing the firing of twenty thousand projectiles devised by other persons. The *results* obtained with the latter may be apparent enough, but the train of reasoning (the fruit of personal experience) which produces these results, remains altogether unknown; for although a man may communicate the result of his experiments, yet he cannot furnish another with his personal experience; and without this it is perfectly impossible to effect, or even to suggest, any important improvement.*

There is scarcely a question—if, indeed, there be one—in the whole subject of dynamics, or the laws which relate to a body in motion, which is not involved in the investigation of the circumstances attending the flight of elongated projectiles; these require to be thoroughly investigated and known before any decided opinion can be given as to the best practical method for constructing rifled cannon. A system founded upon mere guess-work would have a very unsound basis.

It has been too much the custom to speak slightingly of *theory* in gunnery. This is probably owing to the unsatisfactory state of the ordinary theory of gunnery; but the acquisition, in this instance, of a sound theory is of the highest importance. The stride which has been made in the practice of gunnery since Robins's experiments were made known, resulted from his discoveries respecting the laws which govern the flight of projectiles, and respecting the nature of the projecting force. When once a theory had been framed, based upon sound principles, the mechanical improvements followed as a matter of course.

Sufficient attention has not hitherto been paid to the correctness of the principles upon which the cannon and projectile should be constructed. To this chiefly must be attributed the failure of the Lancaster and Whitworth guns—the projectile in the former case acting like a wedge; in the latter like a lever in the bore of the gun.

* The truth of this remark is exemplified in a striking manner by the fact that the rifled cannon and projectiles produced at Woolwich by artillery officers, who had before them the results of all the experiments made from time to time at Shoeburyness, proved most signal failures. This fact also affords a proof of the defective nature of the ordinary theory of gunnery, and of its small utility in estimating the comparative results to be produced with any projectiles.

To produce any great and useful results, a combination of sound theoretical and practical knowledge is necessary, and this can only be obtained by a long and close study of the subject, and by numerous experiments carried on with unremitting attention.

No single invention—as of a projectile—a method of loading at the breech—a peculiar form of groove, or any other mechanical contrivance—is of the least use in itself, unless a perfect combination—such as the proper length of the gun—of the turn—the most suitable metal for the gun, &c.—is obtained for rendering it effective. If each of these be not adapted to the others, the whole must inevitably fail in practice. It is the difficulty of effecting this combination which renders experiments with rifled guns so complicated and costly. If properly conducted experiments had been at first undertaken by the Government at their own expense, instead of relying upon the inventive and pecuniary resources of private individuals for the acquisition of their *data*—which, to say the least, is a rather pitiful course to adopt; for, if a new thing is worth trying, it must surely be worth the cost of the trial—the public would have been spared the expense (amounting to between three and four hundred thousand pounds) of the Lancaster gun factory.

Notwithstanding, therefore, the numerous experiments which have been made in gunnery, and the immense mass of data which must have resulted from them; yet, owing to the desultory manner in which the experiments have been carried on, they have been productive of much fewer practical results than we might reasonably have expected. Experiments with rifled cannon not only require to be conducted systematically; but, to be productive of real benefit, they also require to be conducted by properly qualified persons.

The questions which constantly arise in gunnery experiments are sometimes so complicated and difficult of solution, that none but a mathematician of the highest order can really ascertain the value of the results which are obtained. To conduct experiments in gunnery, therefore, in a proper manner, it is of the first importance to have a good mathematician to collect and arrange the data, and to ascertain the exact numerical value of the results obtained.

It will be also necessary to have a practised experimentalist to profit by these results; one who, with a proper knowledge of cause and effect, is capable of suggesting the best method for the attainment of certain objects. A clever mechanician, to invent and judge of the means which can best be employed for carrying out the plans suggested, should also assist in conducting such experiments, to ensure their being attended with the most useful results.*

The whole of these qualifications are rarely combined in a single individual. Robins was a remarkable exception, and his experiments, in consequence, formed an era in gunnery.

But although the necessary qualities are seldom found in one person, there is no reason why several persons should not be selected, who would, collectively, possess them; and who might either be placed on the Rifled Ordnance Committee, or act with it in such a manner that their services would always be at its disposal, or at that of the presiding officer at Shoeburyness (an important office, for which no one could be better qualified than the gentleman who now fills it); the results of their operations to be finally submitted to a committee of experienced military men of all services, who would be able to judge of their practical value.

A systematic course of experiments conducted under such joint superintendence would be the right course to take for acquiring the proper *data* respecting all the circumstances connected with rifled ordnance, in a much shorter time and more satisfactorily than could otherwise be the case. To conduct experiments in a desultory manner is invariably a useless expenditure of both time and money.

It is impossible for a private individual to undertake such experiments on a sufficiently large scale to be productive of conclusive results; they should be conducted somewhat after the manner of Hutton's experiments, only on a much larger scale, each with a view to some well-defined object. The following are amongst the chief circumstances in connection with rifled ordnance, respecting which some certain data are required, and each should therefore be the subject of a separate course of experiments.

1. Experiments with the ballistic pendulum for finding the different velocities of rifle shot under various circumstances; so that both the *initial* velocities given by different charges of powder, and the loss of velocity—occasioned by the resistance of the air—which the shot suffers in passing through different spaces, shall be thoroughly ascertained. At present literally nothing (certain) is known with respect to these points.

These experiments in the case of rifled shot ought to be attended with better than ordinary results, as the pendulum could be placed at a greater distance than usual, on account of the superior accuracy of flight of rifled shot.

2. The different quantities of friction in the case of both compound and iron shot of different kinds; and the loss of range occasioned by it.

3. The effect produced upon the flight of long shot by any alteration in the position of the centre of gravity.

4. The effect produced by a difference in the form of projectiles.*

5. The difference in the ranges and deflection produced by different elevations with shot of different lengths.

6. The circumstances attending the penetration of long projectiles into various substances.

7. The angular velocity required for shot of different sizes, forms, and density, when fired with different velocities and elevations.

8. The form of groove, (both for iron and compound projectiles,) which shall produce the necessary effect with the least amount of friction.

9. The strength of metal required in the gun, whether it be destined for the employment of iron or of compound projectiles.

10. The *curves*, and also the *times* of flight, of long projectiles; in order to ascertain the best method for securing the greatest amount of efficiency in firing them at high elevations.

11. The effect of windage, especially with iron projectiles.

12. The effect produced by altering the length of the *bore* of the gun.

Besides those which I have enumerated, there are many other points relative to which sufficient data must be fully acquired before unerring results can be obtained. Those who, like myself, have made many experiments on a smaller scale, have acquired sufficient data, perhaps, to form by comparison a general opinion upon all these questions, and (assisted by some acquaintance with the ordinary theory and practice of gunnery) may even have arrived at the power of estimating their effects with a certain degree of accuracy; but the *velocities* of rifled shot when fired with different charges, the *friction*, and many other points, can only be ascertained by a regular course of experiments with the ballistic and gun pendulums, and by other means of much too extensive a nature for a private person to undertake.

Whilst the necessary experiments are being carried on, there is no reason why the country should be deprived of the use of rifled cannon.

* The appointment (since this was written) of Sir W. Armstrong, as Engineer to the Rifled Ordnance Committee, will no doubt prove highly beneficial; in that he appears to possess the last-named qualifications in a very eminent degree.

* It would be a great advantage if the establishment at Shoeburyness were furnished with the means—at least on a small scale—of casting, forging, or altering experimental projectiles, so that they might be tried without delay. It would be a great saving in time, and, eventually, in expense.

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The manufacture of the Armstrong gun may be proceeded with; but we need not confine ourselves exclusively to guns of this particular description. There are several methods by which a supply of very efficient rifled cannon may be obtained without going to an exorbitant outlay in the exclusive adoption of cannon of the most expensive kind, previously to a thorough trial of their merits in actual service, or before the utmost simplicity in their construction is attained. Enough has been said to show that the knowledge which has already been obtained bears but a small proportion to that which remains to be acquired, and that further experiments are therefore necessary.

The accuracy attained with the Armstrong gun is a beautiful mechanical feat, but one which will be commonly performed (and by much simpler means) when a better knowledge of the subject has been acquired; it has shown what can be effected with this particular combination, but little else has been learned from it; and until the truth concerning all the points which I have enumerated, and many others, be clearly ascertained, it will be impossible to decide as to which is positively the best system for the construction of rifled cannon.

To give an example of the change in opinion which experiment will effect, it is a remarkable fact that almost all the circumstances which the Ordnance Select Committee objected to three or four years since, as perfectly inadmissible in the practical adaption of the principle of the rifle to cannon—such as a compound projectile—a projectile composed of many pieces—a breech-loading gun—a gun constructed of wrought iron, especially in such a manner as not to be homogeneous—are united in the Armstrong gun.

In like manner, it will probably happen, when further experiments are made, that the description of rifled gun which will be finally adopted will differ as much from the experimental (for the whole are but experimental) guns which have been tried up to the present period, as these differ from the earlier attempts which were made; for as yet experiment has been directed almost solely to improvement in the mechanical application of a principle of which really very little (certain) is known; instead of being directed to the acquirement of a knowledge of what relates to the principle itself.

This it is which gives rise to such expensive blunders as the Lancaster gun factory; a greater blunder, however, will be committed if we adopt breech-loading guns to the exclusion of all others.* Fortunately, there is to be found amongst the members of each branch of our service a fund of sound common sense, which (and this, upon investigation, will be found, I believe, correct) always leads, eventually, to the adoption of the best thing of its kind, when its superiority has been properly established; although, in most cases, it is effected by a very roundabout and expensive process.

By neglecting, therefore, in this instance, to make proper experiments, we throw away advantages which would enable us to acquire the superiority with regard to projectile effect, the possession of which (especially in a country like our own, the confines of which are all *coast*) should be a matter of primary importance.

* The advantage of the breech-loading system, in allowing the men who serve the gun to be less exposed, is not so prominent with long-range guns as with others; since the former would more frequently be out of the range of musketry.

ASSOCIATION OF FOREMEN ENGINEERS.

THIS Association held their usual monthly meeting at their assembly rooms, 35 St. Swithin's-lane, City, on Saturday, the 3rd instant. Mr. C. F. Hayes read on the occasion a paper on the Manufacture of Rifles. He described with great minuteness many of the processes connected with the completion of these extraordinary *armes de précision*, as carried on at Enfield, and by contractors in various parts of England, Belgium, and America. A large attendance of members, considerable applause, and a unanimous vote of thanks rewarded Mr. Hayes for imparting some valuable information on an interesting subject.

Prior to the reading of the paper it may be stated that several honorary members were elected and others proposed. The anniversary dinner of the Society, postponed many months by reason of the death of the late Chairman, Mr. Sheaves, too, was announced to take place at the above-named place on Saturday, 17th instant, at 6.30 p.m.

Mr. Newton presided.

Our Weekly Gossip.

THE following note has been addressed to the *Times* and *Notes and Queries*:—"In the *Times* of yesterday I observe that as soon as the breaking up of the Tartar frigate is completed in Chatham Dockyard, 'the St. Lawrence, one of the 46-gun frigates, will be taken into the same dock and broken up.' The St. Lawrence is, I believe, no other than that famous old Shannon which fought and captured the Chesapeake in the American war. Her name, having taken an imperishable place in history, was transferred some few years since to the large screw frigate which now bears it, and the renowned old hull has since been lost sight of under the name of the 'St. Lawrence.' If I am not mistaken respecting these facts—and I can hardly be—many will doubtless be glad to learn that a last look may yet be taken of this famous old vessel. —R."

A curious experiment is now being tried at Lyons for laying the dust in public promenades, and has so far been attended with success. A chemist of that city having accidentally spilt some hydrochloride acid on a terrace of his found that it hardened the spot on which it had fallen, and maintained it in a state of permanent moisture. This led him to think that by watering the streets with this acid the dust on large macadamised roads might be laid, or rather prevented from rising. Experiments were first made on the Cours Napoleon between the Rhone and the Perrache station. The success was complete, and has also proved durable, the carriage-way having now been several months free from dust; and another experiment is now being made on the Place Bellecour. During the hottest part of the day the ground, although dry and gravelly, has the appearance of being as consistent and damp as if it had been watered half an hour before. But as evening approaches the moisture becomes more and more perceptible. Every morning the ground is stiffer and more comfortable to walk on. This may easily be accounted for; the acid, decomposing the gravel or stone, forms one or several deliquescent salts, which, therefore, attract the moisture of the air. The question as to whether roads thus watered are likely to last as long as they ought, can only be decided by time.

The following paragraph appeared a week ago in the morning papers:—"The Trinity steam yacht Argus arrived at Harwich from London at about half-past 9 p.m. on Saturday, and had on board an experimental model of Maillard's patent mechanical compass for steering ships without needles or magnets. The instrument was merely lashed in the rudest manner to the after part of the paddle-box, and, notwithstanding the great disturbing force thrown and acting on the steering shaft of the instrument, which is immersed in the water, it worked and gave the ship's course with sufficient accuracy to establish the entire success of the principle on which the compass is constructed, and to justify the inventor's guaranteeing the perfect efficiency of his invention. These instruments are meant to be used in the stern of the vessel, and to stand on deck, where the ordinary compass stands at present; but the inventor selected the position in which his compass was placed on board the Argus, in order to put it to the severest test, and to see it in operation under every imaginable disadvantage. This compass can be used on land, and bids fair to supersede the magnetised needle wherever true bearings are required." We are rather curious to know, and to make known, more of Mr. Maillard's extraordinary compass. His application for the patent has, however, been made so recently that we fear we shall not be able to gratify ourselves and our readers on this head.

The *Times* Woolwich correspondent (who is not averse to marvels) writes:—"A most wonderful long-range cannon, invented by Mr. Jeffries, patentee of the well-known marine glue, is in course of being mounted in the Royal Arsenal, Woolwich, for experiments at Shoeburyness. Its range or flight of shot is spoken of as certain to eclipse every other weapon hitherto known. The gun, with its present bore—namely, a three-inch diameter—weighs seven tons, and presents an appearance (with the exception of the present calibre) similar to one of our 68-pounders. The charge will consist of 16 lb. of powder, and a conically-shaped shot, weighted with lead to 9 lb., and hollowed, similarly to the Minié bullet, which it is presumed will be propelled 15 or 20 miles. Mr. Jeffries, it is stated, has asserted his conviction that it would carry from Dover to Calais. It is the intention of the authorities to carry out a varied and complicated course of experiments under the inspection of the Select Committee of Woolwich Arsenal. After being satisfied of its power in its present form, the bore will be progressively increased to a 68-pounder. To enable the gunners to point the gun, the trunnions will be fitted with a couple of telescopes, to assist the eye over the enormous range predicted."

A very curious atmospheric phenomenon is said to have been produced on Friday morning on the railway wires round Paris. "At 7 o'clock, when the service commences in the various stations, it was remarked at the central station, placed at the hotel of the Minister of the Interior, that some of the instruments were charged with electricity, as if the corresponding station had sent a constant current. It was soon found that the fact was general, the wires at all the stations being in the same state. By interrupting the circuit of the wires strong sparks were obtained. The same thing was produced at the same time on all the telegraphic wires throughout France, the stations placed between two lines receiving the current from each side. At half-past nine the electricity, in place of being permanent, showed itself only at intervals. The scientific authorities were consulted as to the cause of this phenomenon. In stormy weather atmospheric electricity produces many discharges, which set in motion the telegraphic machines, but these discharges are instantaneous, and have not a permanent character." So the paragraph runs.

The production of solid bricks has of late received much of the attention of engineers and architects, with a view of their being produced more economically, of a better quality, and with greater facility, than by the time-honoured means known as "hand-moulding;" and although many mechanical contrivances for making bricks have been introduced, not one has realised the requirement practically, or been considered worthy of adoption, until Mr. Henry Clayton, of the Atlas Works, London, produced and patented his brickmaking machine. Its simple and effective character has lately attracted the notice of the able engineer of the South Eastern Railway Company, the directors of which have now had erected a set of Clayton's patent brickmaking machinery on their premises adjoining the railway station at Folkestone for the manufacture of bricks for the use of the company. On an average 20,000 to 25,000 good bricks are made daily by each of Clayton's large machines, with the attention of two men and four boys.

The following is extracted from the foreign correspondence of the *Star*:—"M. Jobard, of Brussels, who has almost suffered himself to be forgotten, from the lengthened and unusual silence he has maintained for some time past, has come out again as enthusiastic and vivacious as ever with his invention of artificial statuary marble—not the veiny, greasy stuff in use for chimneys and vases, but the pure and spotless Carrara, transparent, polished, and hard as the real substance taken from the quarry. This marble, which is to be prepared for the sculptors in a liquid state, will, like many other artificial inventions, possess an immense advantage over the natural production itself. It can be moulded on the plaster figure, and thus instead of having to hack and hew a shapeless block with great pains and labour, the artist will henceforth realise the genuine impression of his cast at once, and, with scarcely any further exertion, bring out his creation with all the freshness and vigour of the first idea. The invention, which has created an immense sensation in the world of art, is due to a practical chemist of Brussels, of the name of Changy, the same skilful practitioner who discovered the divisibility of the electric light, and the miraculous draught of fishes by means of the chemical light which is sunk at the bottom of the sea. M. Jobard, whose word cannot be doubted, pledges his honour that the table on which he writes has been composed by M. Changy's process, and possesses every quality of the finest marble—and that, after having submitted various specimens of the substance, both black and white, to every chemical test in use, he has come to the conclusion that the composition of marble is no longer a secret of Dame Nature, and that man has at length learnt to rival her in the most cunning of her works, while Art will rejoice at beholding her sons freed from the laborious toil which has hitherto rendered the sculptor's profession so difficult of pursuit."

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NOTICES.

A correspondent asks the title of a work giving in a tabular form the strength of wires of various gauges and metals. Can any of our readers oblige us with this information?

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 213, 299, 309, 312.
BOILERS AND THEIR FURNACES, &c., 260, 261, 282, 284.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 219, 220, 239, 257, 281, 307.
SHIPS AND BOATS, including their fittings, 218, 237, 248, 255, 259, 278.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 216, 221.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 240, 241, 244, 251, 306.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 214, 225, 226, 246, 249, 250, 252, 254, 272, 274, 280, 289, 304, 305.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 255, 282, 297.
LIGHTING, HEATING, AND VENTILATING, 232, 266, 268, 277, 283.
FURNITURE AND APPAREL, including household utensils, fancy-covers, jewellery, musical instruments, &c., 229, 231, 253, 234, 285, 287, 288, 302, 303, 308.
METALS, including apparatus for their manufacture, 217, 264, 270, 279, 292.
CHEMISTRY AND PHOTOGRAPHY, 224, 253, 293.
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MISCELLANEOUS, 215, 223, 227, 230, 235, 238, 243, 245, 247, 258, 265, 267, 271, 272, 276, 285, 290, 291, 294, 295, 296, 301, 310, 311, 313, 314.

213. J. LAUBEREAU. "Improvements in air-engines." Dated Jan. 24, 1859.

This consists in arrangements of machinery for producing the alternate expansion and contraction of air, and in causing the stroke of a piston to be effected by the expanded air, while the return is effected by the pressure of the atmosphere aided by a partial vacuum obtained at the back of the piston. *Patent completed.*

214. J. and W. H. SMITH. "Certain improvements in manufacturing paper, and in producing water-marks, patterns, figures, letters, and devices thereon, and in the construction of the mechanism employed therein." Dated Jan. 24, 1859.

This invention is not described apart from the drawings. *Patent completed.*

215. J. SAVORY and W. R. BARKER. "Improvements in bottles for medicines and poisons." Dated Jan. 24, 1859.

These bottles are formed with six, eight, or more sides, and are fluted vertically, horizontally, or diagonally. The neck of the bottle is formed so that the liquid will flow but slowly or in drops. *Patent completed.*

216. J. FOWLER, jun., R. BURTON, D. GREIG, and J. HEAD. "Improvements in agricultural implements, and in apparatus used for hauling agricultural implements by steam power." Dated Jan. 24, 1859.

Here the patentees employ a wire-rope and a winding drum so constructed as to hold the rope firmly, and draw the implement steadily forward, notwithstanding that the rope only passes partially round the drum. *Patent completed.*

217. A. WARNER and W. TOOTH. "Improvements in the manufacture of iron, and gases for such and other uses." Dated Jan. 24, 1859.

Here in the manufacture of iron in blast and cupola furnaces jets of liquid hydro-carbons are forced in by forcing pumps or apparatus, or by the pressure of a column. The invention also consists in forcing in jets or streams of hydrogen gas into puddling furnaces. To manufacture hydrogen gas a combination of apparatus is employed, consisting of a generator, an instrument to drop water into the generator, and a receiver of the hydrogen gas as it is produced. *Patent completed.*

218. J. G. PROGER and D. DAVIES. "Improvements in lanterns used on board ship to signal to the steersman." Dated Jan. 24, 1859.

A lantern has a single lens turned towards the steersman; it is lighted up at night, and has its cover replaced by a plate of glass in the day. It has also a green and a red glass, the one indicating port, the other starboard. By showing either of these wholly or partially, the steersman is instructed how to put his helm. *Patent completed.*

219. EARL OF CAITHNESS. "Improvements in parts of the permanent way of railways." Dated Jan. 24, 1859.

This consists in making a portion of one or both of the rails at the joints or change of line slide along inclined parallel slots, the two ends of such sliding rails and the ends of the stationary abutting rails being inclined or bevilled to correspond to the incline or bevil of the slots, whereby an overlap bevil joint is obtained. *Patent abandoned.*

220. M. SWAN. "Improvements in ballasting ships, applicable also to the extinguishing fires on board ships." Dated Jan. 24, 1859.

This invention, so far as it relates to the ballasting of ships, consists in constructing the ship with double sides and bottom, that is to say, with an entire inner shell, leaving an air-tight space for water and air at the bottom and sides thereof, forming the ballast chamber or chambers. A semi-circular or other shaped compartment may be made longitudinally over the keel along the bottom of the inner shell, such compartment, which may be sub-divided into a series, being open on its under side so as to receive water from below, and thus form another ballast chamber or set of chambers whilst it adds strength to the ship. This compartment is in direct communication with a valve which admits water through the ship's bottom up to any desired height in the sides, according to the amount of the ballast required, and is also in connection by pipes passing up the inner sides of the ship with the ship's pump. *Patent abandoned.*

221. W. TASKER, jun. "Improvements in ploughs." Dated Jan. 24, 1859.

This relates to fixed headed ploughs, and consists in a construction and arrangement of the parts in connection with the front end of the beam and head gear, whereby the plough may be turned at the headlands without having to be carried round by the ploughman. *Patent completed.*

222. H. OWEN. "Improvements in stockings." Dated Jan. 24, 1859.

This consists in constructing hose, half-hose, &c., with seams or selvage courses about the foot, so that the worn parts may be removed and replaced by new pieces made for the purpose, whereby no overlapping in the seams is required. *Patent completed.*

223. J. H. JOHNSON. "Improvements in machinery or apparatus for cutting and shaping wood." (A communication.) Dated Jan. 25, 1859.

This more especially relates to turning masts and tapered spars, but is applicable to other purposes. The stick of timber is held stationary, being rigidly fixed in the machine, whilst cutters supported in a carriage traverse from end to end of the machine, the cutters revolving at the same time round the stick. *Patent completed.*

224. R. BODMER. "Improved resin and resinous substances." (A communication.) Dated Jan. 25, 1859.

This relates to a former patent dated 27th April, 1858. To get rid of the colour the inventor reduces the temperature at an earlier stage of the process. This modification consists in the addition of a jacket or case to the issue pipe, and the arrangement in connection of apparatus furnishing therewith a constant supply of water or other refrigeratory medium. *Patent completed.*

225. W. CUTTS. "Improvements in the manufacture of bobbins, spools, and cop tubes, and in the machinery employed therein." Dated Jan. 25, 1859.

This consists in manufacturing such articles of paper pulp or other such plastic substance capable of being pressed into the form required. The paper pulp, &c., is run into apertures and compressed by punches. *Patent abandoned.*

226. W. and H. HODGSON. "Improvements in machinery or apparatus for preparing and spinning wool and other fibrous substances." Dated Jan. 25, 1859.

This consists in the use of an endless belt of leather forming a continuous travelling surface for supporting and conducting the fibrous substances from the drawing rollers to the guides of the bobbins. *Patent abandoned.*

227. J. WHITE. "Improvements in means or apparatus to facilitate respiration under water, or under the influence of fire, or in other situations where an artificial supply of air may be required, part of which improvements is also adapted to facilitate movements in or upon the surface of water." Dated Jan. 25, 1859.

Here the patentee provides a close covering for the mouth and nose, and also a water and air or a fire-proof covering for the whole body. In connection with this covering to the nose and mouth there are two pipes each provided with a valve, one with an inlet valve for the supply of fresh air, the other with an outlet valve. The pipe for inhaling fresh air may be in connection with a reservoir, or it may be extended above the surface of the water in free communication with the atmosphere. *Patent completed.*

228. W. ANDREWS. "Improvements in electric telegraphs." Dated Jan. 25, 1959.

This consists in arrangements for preventing the return or induced current from interfering with the proper action of the relay instrument. *Patent abandoned.*

229. F. J. JONES. "An improvement in shirt fronts." Dated Jan. 25, 1859.

This applies to those shirt fronts known as "Dickeys," and consists in a new arrangement of neck-band and collar, which also affords the means of securing the false front on the neck of the wearer. *Patent abandoned.*

230. H. BRECKNELL and J. DYER. "Improvements in cocks and valves." Dated Jan. 25, 1859.

Here the passage of the cock or valve is closed by a vulcanized india-rubber washer or disc, having an annular lip or projection moulded thereon, which lip or projection forms the actual contact surface of the washer when the cock or valve is closed. *Patent completed.*

231. I. WOODCOCK. "Improvements in barometer and thermometer dials." Dated Jan. 25, 1859.

This consists in forming those dials of enamelled paper, card-board, &c. *Patent abandoned.*

232. B. SPEDDING. "Improvements in apparatus for generating and regulating gas, and for impregnating the same with volatile hydro-carbon fluids." Dated Jan. 25, 1859.

The patentee claims, 1, the moveable syphon, or the principle of bringing the oily matter in contact with different parts of the interior of the retort. 2. The lid, moveable in a groove filled with melted lead. 3. The form of retort by which the chimney passes through its centre with an oval or conical bottom. 4. The application of a regulator and apparatus for further impregnating the gas with the vapour of hydro-carbon fluids. 5. The mode of making the diaphragm, together with general arrangement of parts. *Patent abandoned.*

233. C. G. KELVEY and W. HOLLAND. "An improved escapement for chronometers and other time-keepers." Dated Jan. 25, 1859.

According to the specification of a former patent (dated Oct. 17, 1857,) the inventors applies two rollers to the balance staff. Instead of these two rollers they now employ but one, so that when the proper relative positions of the impulse pallet and the ruby or gold pin are once obtained, no readjustment of the parts will be required. *Patent abandoned.*

234. W. E. NEWTON. "An improvement in life-preserving vests." (A communication.) Dated Jan. 25, 1859.

This relates to vests for ordinary wear, but which are furnished with a float of india-rubber, &c., that can be inflated at pleasure in a few moments without the removal of the vest from the person. *Patent completed.*

235. W. R. ALEXANDER. "Improvements in furnaces, and apparatus for the manufacture of sugar, and for the consumption or prevention of smoke. Dated Jan. 27, 1859.

This consists in effecting the perfect combustion of the fuel, and preventing the discharge of smoke, by an efficient supply of highly-heated air, subdivided into numerous minute jets. *Patent completed.*

236. I. HAMMOND. "Improvements in breech-loading fire-arms, and in cartridges to be used therewith." Dated Jan. 27, 1859.

This invention is not described apart from the drawings. *Patent completed.*

237. O. HUSSEY. "Improvements in the construction of ships' blocks." Dated Jan. 27, 1859.

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This consists in fitting the frame with a strap, which allows the sheaves with the frame in which they are mounted to slide a distance within it. A spring of india-rubber is used to keep the frame with the sheaves when the strain is small at the extremity of the strap, but when a sudden jerk comes on the block the spring yields and allows the frame and sheaves to approach for the moment the other end of the strap. *Patent completed.*

238. D. GRAHAM. "An improved method of driving centrifugal machines." (A communication.) Dated Jan. 27, 1859.

This consists in making the vertical shaft that supports the centrifugal hollow at the lower end, with one or more horizontal arms or jets, and connected by pipes and a regulating cock with a vessel or head of water, in which a sufficient pressure of water is maintained to bear the weight of the shaft and drum, with its charge of sugar, &c., to be operated upon. The water will issue from the jets with a force due to the pressure required to buoy up the machine, and make it revolve at any required velocity, the velocity being regulated by the distance of the jets from the centre, and by the size of the orifices. *Patent completed.*

239. J. WELLS and W. CLOUGH. "An improved coupling for railway carriages and analogous uses." Dated Jan. 27, 1859.

Here the carriages are provided with a link at one end and a crook at the other. The noses or hooked ends of the crooks are formed with an incline, so that the link will slide up the incline, and will then drop over the hook on to the bar of the crook. *Patent abandoned.*

240. F. C. C. PAULSEN and A. ALSING. "Improvements in preparing beverages usually called punch." Dated Jan. 27, 1859.

This consists in certain methods of, and in the combination of various ingredients for, the preparation of champagne punch, pine apple punch, arrack punch, and rum punch, which we cannot refer to in detail. *Patent completed.*

241. M. FERNANDEZ. "Improvements in straw and hay cutters." Dated Jan. 27, 1859.

This invention is not fully described apart from the drawings. *Patent abandoned.*

242. J. KERR. "Improvements in the construction of revolving fire-arms." Dated Jan. 27, 1859.

This relates, 1, to those parts of repeating fire arms used for securing the barrel and frame to the stock; 2, to the means of imparting rotary motion to the chamber of repeating fire-arms. There are several detailed arrangements described for carrying the invention into effect for which we cannot give space. *Patent completed.*

243. J. MERCER. "Improvements in the process of currying leather." (A communication.) Dated Jan. 27, 1859.

Here the inventor takes the hides direct from the tan vat or pit, and places them in a machine (similar say to a cotton or cider press) and subjects them to a pressure sufficient to expel the moisture or liquor. He then takes the hides and applies stuffing or grease to them, so that they will be plumped up and made to receive the grease to advantage. *Patent abandoned.*

244. W. AGER. "Improvements in machinery for cleaning rice." Dated Jan. 27, 1859.

This consists in forcing cool air through the body of the rice during the cleaning operation of removing the inner pellicle in order to prevent its heating. *Patent abandoned.*

245. T. HARTSHORNE. "An improved metal to be used for making journey brasses for mills, rollers, forges, and all kinds of shafts and machinery, and also for shipping, and for bearings for shafts and journey brasses in general." Dated Jan. 27, 1859.

This metal will be composed of iron, copper, tin, and reckelous (or regulons) of antimony. *Patent completed.*

246. E. DIXON and H. WHITTAKER. "Improvements in apparatus used in weaving textile fabrics." Dated Jan. 27, 1859.

This consists in an arrangement of self-acting mechanism to be applied to the ordinary shuttles employed in weaving textile fabrics, whereby the stoppage of the loom will be accomplished by the breaking of the weft thread whenever a float or imperfect shed occurs. *Patent completed.*

247. J. MEACHAM. "Improvements in pens and penholders." Dated Jan. 27, 1859.

The object here is to give the writer two pens on one holder. *Patent abandoned.*

248. H. D. P. CUNNINGHAM. "An improvement in the rig of ships or vessels." Dated Jan. 27, 1859.

This consists in a kind of rig which the inventor designates "Double gaff rig," the object being to enable a ship to lie nearer the wind than with sails as ordinarily arranged. *Patent abandoned.*

249. H. RAWSON. "Improvements in machinery for preparing wool and other fibrous substances." Dated January 27, 1859.

Here the fibre is first conducted between a pair of feeding rollers which carry it forward at a uniform speed; after passing the feeding rollers, the fibres enter amongst teeth which travel with it. These motions cause the teeth first to enter the fibre, then to travel away from the feeding rollers, and afterwards to pass out of the fibre. The patentee prefers to actuate the teeth by a screw gill. In front of the travelling teeth is a plate or frame having a vibratory motion imparted to it in a direction to and from the travelling teeth, and such plate or frame has openings through it for the passage of the teeth of a comb. This comb travels with the plate or frame, and each time that the latter moves from the travelling teeth, the teeth of the comb are projected up through it into the fibre. *Patent completed.*

250. J. BUCKINGHAM and G. SALT. "Improvements in the construction and adaptation of drawing and other rollers employed in drawing and compressing fibres, which improved construction of rollers is also applicable in compressing fabrics." Dated Jan. 27, 1859.

This mainly consists in constructing drawing and other rollers by the application thereto of woollen cloth, &c., between the outer cylinder or covering of prepared india rubber, and the internal boss or other roller to prevent slipping of the india-rubber covering thereon. *Patent completed.*

251. E. T. HUGHES. "Improvements in the manufacture of biscuits." (A communication.) Dated Jan. 27, 1859.

Here gluten is mixed with wheaten flour, and then mixed with oil, butter, &c., in certain portions. *Patent completed.*

252. G. F. BRADBURY and J. J. KING. "Improvements in certain apparatus applicable to sewing machines." Dated Jan. 27, 1859.

This relates to the binding guide, and consists in forming it of an internal block surrounded by an external case, having a space between them through which the binding passes until it arrives at the end of the block, when it is drawn at or near right angles to the space through a curved groove at the end or side of the block of the desired form and size of the exterior of the binding, leaving the interior free to cover the article to be bound and held close to it until the stitch is made. *Patent completed.*

253. W. CROWTHER. "Improvements in the manufacture of prussiates of potash or soda, and in recovering a useful material therefrom." Dated Jan. 27, 1859.

Here the horn, wood, or other substance is first treated with a hot solution of potash or soda by which it is dissolved. This liquid is then evaporated to dryness; after which the product is placed in the usual pot and submitted to the required temperature for fusion. By the same process prussiates of potash are manufactured from woollen and other materials. *Patent completed.*

254. J. GATHERCOLE. "Improved machinery for manufacturing envelopes and paper bags." Dated Jan. 27, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

255. I. ZACHERONI. "An improved method of preventing the escape of smoke into the atmosphere, and in the construction of chimney pots or tops for curing smoking chimneys." Dated Jan. 28, 1859.

This consists in constructing the chimney without an opening at the top in two or more shafts, to allow the smoke to ascend one or more, and descend by the others, which have valves opening one way, so that the smoke cannot return. These downward shafts terminate in large chambers, wher the smoke will be deposited as soot, the gases that have not lodged being returned to the furnaces or fires for combustion. The deposit can be used as a fertilizer. *Patent completed.*

256. W. ROBERTSON. "A new apparatus for propelling boats on canals, rivers, and lakes, of moderate depth." Dated Jan. 28, 1859.

This consists in the use of an endless chain or chains passing over pulleys so fixed and arranged upon the boat as to be capable of being supported and moved forwards or backwards by them, and the chain or chains being of such a length that they reach to and lie upon the bottom of the canal, river, or lake to be navigated. *Patent completed.*

257. G. BARTHOLOMEW. "Improvements in shoes for horses and other animals requiring such shoes, and in the means of attaching the same to the feet." Dated January 28, 1859.

Here the shoe may be formed in the ordinary way except that on each side it is separated from that forming the front, and the parts are connected to a steel or other elastic plate by which flexibility between the fore and hind parts of the under surface of the shoe is attained. These parts of the shoe are attached to an outer frame or wall rising up the hoof, and extending from the front backwards. The shoes are attached to the hoof in a manner similar to that described in the specification of a previous patent, dated Feb. 1, 1858. *Patent abandoned.*

258. C. E. AMOS and J. FRANCIS. "Improvements in water pressure engines, and their application to pumping machinery." Dated Jan. 28, 1859.

This invention is not described apart from the drawings. *Patent completed.*

259. F. PRINCE. "A new breech-loading gun." Dated Jan. 28, 1859.

This consists principally in a new plan for opening and closing the breech-end of fire-arms for inserting the cartridge at the said breech-end; also, in an improved method of priming the arm. *Patent completed.*

260. W. YATES. "Improvements in furnaces." Dated Jan. 28, 1859.

This consists in forming the fire-doors of furnaces in two parts moving on an axis or upon axes, so that one part may be opened more or less to regulate the admission of fuel which is thrown in above it, and the other part to be closed ordinarily, but to be capable of being opened to afford entrance to the interior of the furnace. In this latter part a slide door is placed to admit tools for stoking the fire, &c. Some of the fire-bars are made moveable together, and are worked by hand or by machinery, so as to force the fuel gradually down the bars and to keep it stirred. *Patent abandoned.*

261. R. GRIFFITHS. "Improvements in regulating the pressure of steam in boilers, and in preventing the accumulation of deposit therein." (Partly a communication.) Dated Jan. 28, 1859.

Here, to regulate the pressure of steam in steam-boilers, the steam is caused to act upon apparatus in connection with the damper, so that the apparatus may partially open or close it according as the pressure is less or greater than that which it is wished to maintain. The accumulation of deposit is prevented by a number of balls being placed in the boiler and kept in motion by the action of the water. *Patent abandoned.*

262. H. WATSON. "Improvements in the manufacture of Knotter plates, used in the manufacture of paper." Dated Jan. 28, 1859.

The peculiarity of this invention consists in arranging the circular saw to cut from the reverse or smooth side of the plate. *Patent completed.*

263. A. BARCLAY. "Improvements in obtaining and distributing or applying electricity and magnetism." Dated Jan. 28, 1859.

The specification of this invention is too elaborate to be quoted here at any sufficient length. *Patent abandoned.*

264. L. LEISLER. "Improvements in extracting metallic copper from the pyrites residuum of vitriol works, and from other substances." (A communication.) Dated Jan. 29, 1859.

The patentee takes the pyrites, residuum of the vitriol works from which the whole or the greater part of the sulphur has been turned off, and treats it in suitable vessels with muriatic acid largely diluted with water. *Patent abandoned.*

265. J. LANE. New or improved machinery for the manufacture of screws, and for tapping nuts for screws." Dated Jan. 29, 1859.

This invention is not described apart from the drawings. *Patent completed.*

266. J. MACKENZIE. "An improved method of operating ventilating valves, especially applicable to ventilating gas-burners." Dated Jan. 29, 1859.

This consists in closing the exit passage of ventilating gas-burners by a valve opened by the pressure of the gas flowing to the burner, and closed upon the pressure being withdrawn or cut off. *Patent completed.*

267. J. MARINO. "An inodorous closet or commode." Dated Jan. 29, 1859.

This invention is not described apart from the drawings. *Patent completed.*

268. G. DAVIES. "Improvements in apparatus applicable to measuring, regulating the pressure of, and consuming gas for illumination." (A communication.) Dated Jan. 29, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

269. H. GRISELL. "Improvements in machinery for moving ships or vessels on slips or inclined ways." Dated Jan. 29, 1859.

The hydrostatic presses are arranged to act in succession on a chain so as to produce a continuous motion to such chain and to the cradle or carriage connected thereto. *Patent completed.*

270. J. J. A. de BRONAC and A. J. M. DEHERRYPON

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"A new or improved process for treating metallic sulphurets, phosphurets, arseniurets, antimoniurets, and particularly sulphuretted ores of lead, antimony, copper, silver, zinc." Dated Jan. 29, 1859.

The principle of this process is based upon the energetic re-action to which spongy iron is subject. The chief advantages resulting are, 1, the suppression of the preliminary roasting. 2. The rapid extraction of the sulphurets at a low temperature from different metals. *Patent completed.*

271. J. MEACHAM. "Improvements in apparatus for clasping and closing books, purses, reticules, and other similar articles, and for retaining and securing paper, documents, letters, bills, and other memoranda." Dated Jan. 29, 1859.

This consists, 1, of an elastic clasp, the sides of which are rigid, but the clasp being elastic allows of the insertion of papers, &c. 2. Of an elastic band for closing books, &c. The band has a rigid loop for receiving the back of the book, and two hooks are fastened to the covers. The band is then secured by a stud and slot, and forms a spring-clasp, so that the book is fastened while it will admit of being opened to receive papers. 3. Of an elastic band with hooks or other similar fastenings. *Patent abandoned.*

272. T. P. SMITH. "An apparatus for guiding or directing the pen or pencil in writing or drawing." Dated Jan. 31, 1859.

The patentee places on the forefinger of the right hand a ring and rest or hook of such shape as to allow the pen shaft or pencil to rest therein. *Patent completed.*

273. D. BENTLEY. "Improvements in self-acting apparatus, applicable to letter-press printing-machines for supplying and removing the paper." Dated Jan. 31, 1859.

This consists in applying to letter-press printing-machines an air cylinder to which suitable jointed or flexible pipes are connected. The air cylinder has a piston, which in moving forms a partial vacuum in the pipes, and this vacuum is made available for lifting the upper sheet of paper from the pile by which the printing machine is supplied, and suitable machinery is employed to bring forward the sheet of paper so lifted. *Patent abandoned.*

274. J. RAYWOOD. "Certain improvements in the construction and method of working sewing machines." Dated Jan 31, 1859.

This invention is not sufficiently described apart from the drawings. *Patent completed.*

275. T. WILSON. "Improvements in breech-loading and other fire-arms. Dated Jan. 31, 1859.

This consists in certain methods of constructing the breech ends and locks of fire-arms in order that a longer and lower spring may be employed than in the ordinary construction, and an easier action obtained. *Patent abandoned.*

276. J. ROBERTSON. "Improvements in details, by which motive force is transmitted in machinery." Dated Jan. 31, 1859.

This invention is not described apart from the drawings. *Patent completed.*

277. H. J. NEWCOMBE. "An improved apparatus for heating or warming buildings." Dated Jan. 31, 1859.

This consists of a furnace of suitable construction, in connection with which are several series of pipes, suitably arranged for heating the various parts of a building. The heat is regulated by dampers. *Patent abandoned*

278. J. P. BOOTH. "Improvements in ventilating ships." Dated Jan. 31, 1859.

This consists in causing currents of air to pass through vertical or downcast shafts, communicating with horizontal, longitudinal, or transverse shutes having apertures suitably arranged for conveying the air to any desired part of the ship." *Patent completed.*

279. A. V. NEWTON. "An improved method of extracting gold and silver from their ores." (A communication.) Dated Jan. 31, 1859.

Here the ore is first broken fine and sifted, after which chloride of sodium is added and thoroughly incorporated by being passed through a burr-stone mill. This mixture is then placed in a furnace for roasting. The ore is next ground with the admixture of wood ash, and bolted fine. The mass is next placed in the amalgamator, and sufficient water added to cause the mercury to separate into globules and filter through it. Soda ash is next added to cleanse the mercury. To this mass pieces of bar iron are now added to facilitate the trituration. The amalgamator being put in motion, the mercury is then to be applied, and 6lb. shot added to act as triturator. The machine is then again set in motion, and the temperature raised to about 150° Fah: After a time sulphate of iron in solution is added to decompose the chloride of gold, and precipitate it in the metallic state. The consistency of the mass is next reduced by adding hot water thereto, and the motion of the machine continued until the globules of mercury collect in a body. The mercury is then drawn off, and the residuum washed, after which the mercury may be separated from the gold by any process now known. *Patent abandoned.*

280. J. GRIMOND. "Improvements in the manufacture of hearth rugs." Dated Feb. 1, 1859.

This consists in manufacturing hearth rugs of jute, or jute hemp, with a mixture of cotton, or wool, or other suitable fibre. The patentee weaves the same in a "kidder" loom. *Patent completed.*

281. L. RIGOLIER. "A new brake for railway carriages." Dated Feb. 1, 1859.

This invention is not described apart from the drawings. *Patent completed.*

282. J. HOSKING and T. COCK. "Improvements in furnaces or fire-places." Dated Feb. 1, 1859.

The object here is to improve the draught, and the invention consists in closing the back of the furnace, where the bridge is ordinarily placed, and in closing the ash-pit, where the draught is usually admitted to the grate. The ordinary fire-door is dispensed with, and the door-way thus becomes the opening for the admission of the draught, which will pass down below the fire-bars to the ordinary flue leading to the chimney: *Patent abandoned.*

283. S. B. EVELEIGH. "An improved form or construction of hats or covering for the head." Dated Feb. 1, 1859.

This relates principally to hats for police officers, and the invention consists in the combination of the peculiar form of the military "chaco," with the ordinary brimmed hat of the civilian. *Patent completed.*

284. R. NEEDHAM. "An improved water-gauge for steam-boilers." Dated Feb. 1, 1859.

This consists, 1, in providing in the gauge very large passages for the water in order that they may not become choked. 2. In the use of a hollow conical plug in the taps or valves of water gauges, so constructed that the water is supplied to the gauge through the hollow plug, and communication made with the boiler and shut off thereby. *Patent completed.*

285. S. PLIMSOLL. "Mining apparatus for use in mining coal and other minerals, and also for separating the small coal and crushed ores from the shale, dirt, and other matters with which it may be in combination, and for drying the same." Dated Feb. 1, 1859.

This consists, 1, in substituting for the pick a circular or segmental saw, centring in a saddle which traverses one, two, or more parallel rods of iron, placed horizontally for undermining, and vertically for the perpendicular cuts required for straight work. 2. In separating the small coal from the shale, &c., by producing the required action of the water by turning the steam into the water below the coal or crushed ore, thereby dispensing with steam engines. The steam pipes are to be coated with white enamel to diminish the radiation of heat. The drying is effected by hot air. *Patent abandoned.*

286. M. A. WALKER and R. WALKER. "Certain improvements in the manufacture of percussion caps, and in the apparatus for effecting certain parts of the same." Dated Feb. 1, 1859.

This consists, 1, in the means of lining and waterproofing percussion caps. 2. In the form of the blank or shells of percussion caps as applied in a particular way for the discharge of fire-arms. 3. In the mechanical arrangements for giving effect to certain parts of the invention. *Patent abandoned*

287. R. GORMULLY. "Improvements in pianofortes with upright frames." Dated Feb. 1, 1859.

Here the strings are placed diagonally from back bottom to front top, or the reverse, either as a simple diagonal, or as a transverse diagonal. The strings are attached to a loose frame, the upper part or rest plank of which is formed of two pieces, between which the strings are attached to rest, formed so that the pull of the strings is direct. Or the strings are attached to a solid face, thick at the base end, and thin at treble end. The sound board is loose to allow of free vibration. To such backs is applied the action ordinarily only used in the grand horizontal pianofortes, with its checks, dampers, &c., the object being simplicity and strength. The sound board is of glass or paste board. The ends of the instrument are formed of fretwork in wood, metal, gutta-percha, silk, or long cloth. The keys are of crystal, and arranged chromatically. The name board is of crystal. The centre of top rail of top door has a stick for a candle or lamp, so that light may fall direct on the music book beneath. *Patent abandoned.*

288. T. P. PURSSGLOVE. "Improvements in barometers." Dated Feb. 1, 1859.

Here the inventor adjusts a chamber on the upper end of the mercurial column, this chamber having a depth of from four to five inches, and with any convenient breadth. From the lower end of this chamber he leads a spiral zig-zag or straight tube. This tube passes down either a portion, or down the whole of the remaining distance of the 31 inches of vertical height, including the chamber and lower portion of the pipe. To the lower part of this tube or column of mercury he attaches a flexible bag which is in communication with the vertical column. This bag does not depend upon the end of the column, but is attached to suitable mechanism so arranged as to indicate the variations of the atmospheric pressure, which will cause a corresponding increase or diminution in the weight of the mercury that is at the lower end. This bag not being rigidly attached to the tube can be accurately adjusted to the mechanism above referred to, and the weight thereof will thereby be indicated. *Patent abandoned.*

289. R. A. BROOMAN. "Improvements in sewing machines." (A communication.) Dated Feb. 1, 1859.

This relates to the employment of a barbed needle, and consists, 1, in a means of actuating the said needle whereby its movements through the material shall also produce the feeding of the same. 2. In a method of regulating the vibration of the said needle whereby the feed for giving the various lengths of stitches is obtained. The invention is not described apart from the drawings. *Patent completed.*

290. G. A. WALLER. "Improvements in the means of, and apparatus for, expressing liquid from semi-fluid substances and other substances containing liquid." Dated Feb. 1, 1859.

This consists in expressing liquid from semi-fluid substances and others containing liquid by the pressure of water or other liquid, or of air, gas, or other fluid forced into a bag or case introduced into a vessel with perforated sides, or with sides formed of bars with apertures between them, or otherwise constructed to allow of the passage of liquid through them. *Patent completed.*

291. M. LOAM. "Improvements in machinery for raising sewage and other waters and matters." Dated Feb. 1, 1859.

This consists in raising the sewage, &c., by means of a wheel having buckets suitably arranged around its inner periphery, and a trough or canal suitably placed to receive the contents of the buckets as the wheel revolves. *Patent completed.*

292. C. CROCKFORD. "A mode or method of producing metallic sulphates." Dated Feb. 1, 1859.

This consists in exposing the oxides of chlorides of copper, iron, zinc, &c., to the action of sulphurous acid gas, or the vapour of water charged with air, whereby they become converted into sulphates. *Patent abandoned.*

293. M. HENRY. "The manufacture and useful applications of certain bituminous products and compounds of bitumen and other matters, and treating and applying certain natural bitumen or bitumens for such purposes." (A communication.) Dated Feb. 1, 1859.

This appears to relate chiefly to the treatment of a bituminous substance found in the West Indies, and known as "chapatote." In the process preferred the bitumen is melted a little at a time in a close furnace boiler, and when sufficiently fluid the heat is reduced so as to allow it to simmer, stirring it from time to time; resin or other oil may be added to it, the temperature raised, and inert substances combined with it in another boiler and furnace, and the compound poured into moulds powdered with clay. *Patent abandoned.*

294. E. H. BENTALL. "Improvements applicable to machinery for grinding or pulverising various substances." Dated Feb. 1, 1859

This consists in enclosing the grinding apparatus in a chamber, and admitting a blast of air to the bed of the grinding mill, so as to blow away the fine particles directly they are formed. These fine particles are conveyed away from the grinding chamber to another close chamber in which they are allowed to settle, and as the distance they are carried by the blast will depend upon the weight of the particles, it will be evident that by dividing the settling chamber into compartments powders of different degrees of fineness will be obtained. *Patent completed.*

295. W. E. NEWTON. "An improved blowing machine." (A communication.) Dated Feb. 1, 1859.

The object here is to produce a steady, continuous, and uniform blast which is capable of being altered or modified at pleasure. The invention is not described apart from the drawings. *Patent completed.*

296. E. E. ALLEN. "Improvements in stereoscopic apparatuses." Dated Feb. 2, 1859.

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These improvements consist in mounting stereoscopic views upon suitable lengths of silk, which are wound upon rollers fixed in cases which collapse, the rollers being operated upon by means of ivory thumb-screws. The stereoscopes are also made colapsible, and are attached to the cases containing the views. When not in use the cases, with a hundred or more views and stereoscope complete, measure only seven inches in length, three inches in width, and two inches in depth. When opened out for the exhibition of the views the cases are extended to a suitable width, the stereoscope being lifted up and adjusted to any sight. *Patent completed.*

297. E. WILKINS. "Improvements in drain pipes and tiles for draining and liquid manuring land." Dated Feb. 2, 1859.

This consists in forming half round drain pipes with scalloped or vandyked openings or spaces along one or both of their longitudinal edges, so that when laid down upon a flat surface with their convex sides uppermost there shall be small spaces or openings for the exit or entrance of liquid, so as to serve either for draining or for distributing liquid to the subsoil of land. *Patent completed.*

298. R. LANCASTER. "An improved mode of ventilating coal and other mines." Dated Feb. 2, 1859.

This consists in supplying heated air to any portion of the upcast shaft, by which means the air is rarefied therein, and the atmospheric air descending the downcast shaft to fill up the partial vacuum thus formed produces the requisite current of fresh air for ventilating the mine. The air is highly heated by a furnace placed at the mouth of the pit, and forced the requisite distance down the upcast shaft by a blast-engine. *Patent abandoned.*

299. F. F. RATEAU. "An improved steam-engine actuated by regenerated steam." Dated Feb. 2, 1859.

Here the steam is generated at about three atmospheres pressure in a boiler surrounding the fire-box, and on issuing from the boiler is conveyed into a superheating receiver placed within the fire-box. The steam superheated being thus brought almost simultaneously to a very high pressure, rushes from the receiver into the steam chest of a horizontal cylinder, where it is distributed in the usual way by a slide valve; as it escapes therefrom it is conveyed by a pipe to a second cylinder, where it expands and works in the same way; thence the steam is conveyed back to the boiler, which it enters freely after raising a valve, because its pressure is still higher than that of the steam in the boiler. The steam cylinders are in a horizontal position, their rods being in a straight line are keyed, working in suitable guides; the slide has the shape of a frame standing upright, and a special brace, in which a cranked pin or cranked shaft journal revolves, sliding up and down in the slide, so that the main shaft is caused directly to revolve by the two sliding motions without the help of a connecting rod. *Patent abandoned.*

300. J. R. COOPER. "Improvements in breech-loading fire-arms." Dated Feb. 2, 1859.

This consists in certain methods of connecting the barrels of breech-loading fire-arms with the break off of the said fire-arms, by which the charge and discharge may be rapidly effected. *Patent abandoned.*

301. S. TEARNE. "Improvements in ornamenting surfaces." Dated Feb. 2, 1859.

This consists essentially in gilding, silvering, or bronzing the said surfaces on those parts to which the design is to be applied, and in afterwards transferring thereto designs printed upon transfer paper, the said transfer designs concealing certain parts of the gilded, silvered, or bronzed surface. *Patent completed.*

302. J. BUNCHER. "Improvements in the manufacture of eyes or fastenings for stair rods." Dated Feb. 2, 1859.

This consists in manufacturing the eyes or fastenings of stair rods by piercing or drilling, and bending strips or bands of rolled or drawn sheet metal, or flat or other shaped wire. *Patent completed.*

303. I. CLEMENTS. "A new or improved method of manufacturing curtain rings." Dated Feb. 2, 1859.

This consists in manufacturing curtain rings by first cutting rings from sheet metal, and afterwards shaping the rings by suitable dies. *Patent completed.*

304. J. HIRST, jun., and J. HOLLINGWORTH. "Improvements in the construction of power looms." Dated Feb. 2, 1859.

This relates, 1, when a series of lifting shuttle boxes is used to operating them by a series of cams or tappets capable of being slid so as to bring the particular cam or tappet into position to operate upon the connecting means to the boxes in order to insure the box required being brought into a line with the race or lay, and at the same time operating supporting catches to such boxes to release them to the extent desired to enable the particular catches alone to come into position to support the particular box. The sliding of the tappets is effected by an *L*-lever, or *L*-levers operated by chains of pattern surfaces; and such *L*-levers are held between the changes of surfaces by catches or otherwise. 2. To clearing the weft when a series of rising boxes is used. For this purpose the front part of the lay is cut away, the filbow is attached to the end of the lay, and the lay sword and the shuttle-boxes at the part adjoining the lay, as is also the lay, are bevilled to admit of the weft falling down out of the way of the upper shuttles. *Patent completed.*

305. G. LEACH. "Improvements in leasing yarn or thread in the hank, and in machinery for winding off the same." Dated Feb. 2, 1859.

This relates, 1, to a mode of dividing the hank into given portions, and preserving such divided portions so that the thread or yarn may be correctly placed upon the swift or holding apparatus for being wound off. 2. To a novel machine for holding the yarn, &c., while being wound from the hank. *Patent completed.*

306. H. F. KEMP and W. SKEY. "An improved food for cattle." Dated Feb. 2, 1859.

This relates to the manufacture of food for cattle to be used either in the form of cake or meal, from beet and other such like roots after distillation, maceration, or expression, either separately or combined with other substances. *Patent abandoned.*

307. T. STORER. "A new or improved funeral carriage." Dated Feb. 3, 1859.

This consists of a carriage the body of which is divided by a transverse division into two compartments, entrance to one of the said compartments being by doors at the sides of the carriage, and to the other by a door at the back of the carriage, the receptacle for the coffin being situated under the floor of the carriage. *Patent completed.*

308. J. WOODROW. "Improvements in the manufacture of hats or coverings for the head." Dated Feb. 3, 1859.

This consists in the use of a woven fabric called "Swiss tissue," as an external covering for the foundation or body of summer hats. *Patent abandoned.*

309. W. CLAYTON and J. GOODFELLOW. "Certain improvements in metallic pistons." Dated Feb. 3, 1859.

This relates to what is known as Goodfellow's patent piston, and consists in the use of a fourth or extra ring in the form of an annular wedge, and so placed within the piston and behind the three ordinary annular springs or packing, that as the said springs lose their expansive force and become weaker, and in consequence of wear the two outer rings become of less diameter, the annular wedge-formed spring is caused to exert an outword force upon them, and thereby maintain perfect contact between the cylinder and piston. The expansive force of this wedge may be increased to any required extent by steel "set screws." *Patent completed.*

310. H. C. JENNINGS. "Improvements in the manufacture of paper and artificial parchment, and of gelatine applicable to the sizeing of the same, and other purposes." Dated Feb. 3, 1859.

This relates to the manufacture from the fibrous parts of fish, of a paper or parchment, and of a gelatine suitable for sizeing the same. *Patent completed.*

311. J. PETRIE, jun., and T. WRIGLEY. Improvements in machinery or apparatus for washing rags and other materials for the manufacture of paper." Dated Feb. 3, 1859.

This invention is not described apart from the drawings. *Patent completed.*

312. S. D. DAVISON. "Improvements in locomotive steam engines." Dated Feb. 3, 1859.

This relates to tank engines, and the main improvement consists in forming the sides of the tank by the longitudinal side-frame plates of the engine. *Patent completed.*

313. A. G. POOLEY. "Improvements in preparing fish for manure, and in apparatus for the same." Dated Feb. 3, 1859.

This consists in submitting the fish to the action of steam, and subsequently to pressure. The apparatus consists in perforated cylinders, having pistons working in them for the compression of the fish. Suitably arranged pipes convey the steam to the cylinders. *Patent abandoned.*

314. M. SMITH. "Certain improvements in looms for weaving." Dated Feb. 4, 1859.

This relates, 1, to those looms in which a jacquard or index machine is used for working the healds in combination with a box containing two or more shuttles. When a chain of lags with pegs is used to act on the hooks which work the healds, the inventor makes use of a series of pegs on the same lags, which act on a lever when a change in the shuttle box is required, and liberates a catch lever by which the mechanism for working the chain of tappets is brought into action. As soon as the requisite change in the position of the shuttle-box has been effected, the catch lever is again held by the lever actuated by the pegs, and the parts remain in action until another peg on the chain of lags again liberates the catch lever, and the position of the shuttle-box is then again changed according to the shape of the next link in the tappet chain. When jacquard cards are used to act on the healds the inventor produces the requisite changes in the position of the shuttle-box by a needle acted upon by the jacquard card. It relates, 2, to a patent granted to W. B. Hayes 14th September, 1854, and consists in supporting the axles of the endless chain shuttle-box by a star wheel, and in machinery for stopping the loom when the shuttle fails to enter that compartment of the shuttle-box that is in a line with the shuttle rail. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated July 12, 1859.

1654. T. Wright. Improvements in the permanent way of railways, and in the means of preventing accidents thereon.

Dated July 30, 1859.

1770. H. J. Newcombe. An apparatus for heating or warming buildings.

Dated Aug. 1, 1859.

1782. E. de Bassano. Improvements in the manufacture of artificial fuel, commonly called patent fuel.

Dated Aug. 5, 1859.

1802. B. Tweedy. An improved mode of and apparatus for consuming smoke in locomotive and other engine furnaces, whereby coal can be used instead of coke.

Dated Aug. 6, 1859.

1812. W. R. Drake. An apparatus for conducting electricity in the sea, and for telegraphing and sounding in deep water. (A communication.)

Dated Aug. 9, 1859.

1848. J. Waite. Improvements in making infusions for pharmaceutical purposes, which improvements are also applicable to other purposes of a similar nature.

Dated Aug. 11, 1859.

1856. W. White. A four-wheeled safety sociable carriage.

Dated Aug. 16, 1859.

1888. J. H. G. Rex. Improvements in the construction of dwelling-houses or other buildings, for the purpose of facilitating the escape of the inmates in case of fire.

Dated Aug. 17, 1859.

1892. J. Sidebottom. Certain improvements in power looms for weaving.

1896. S. Beardmore. Improvements in electric batteries.

Dated Aug. 18, 1859.

1898. W. Grimshaw and S. Mason, jun. Improvements in machinery and apparatus employed in washing, bowking, bleaching, and preparing flax, and other substances.

1900. A. J. Canu. Improvements in machines for breaking or crushing stones, minerals, or other similar materials.

Dated Aug. 19, 1859.

1904. P. Salmon. Improvements in locomotives, and in apparatus for warming trains of carriages connected thereto.

1905. W. T. Henley. Improvements in machinery for the manufacture of ropes and cables, and for paying out and picking up submarine telegraph cables.

1906. S. Boult. Improvements in the means of, or apparatus for retarding railway carriages.

1907. J. Jackson and J. Thorley. Improvements in hoists for raising and lowering weights.

1908. J. Fowler, jun., R. Burton, D. Greig, E. E. Allen, and W. Worby. Improvements in ploughs, cultivators, or tilling implements, and in machinery for giving motion to the same by steam power.

1909. H. W. Harman. Improvements in steam boilers, and in working the same, and in safety valves, and apparatus connected therewith.

Dated Aug. 22, 1859.

1911. E. Hardon. Certain improvements in looms for weaving.

1912. W. Finegan. Improvements in apparatus for lubricating machinery.

1913. D. Grant. Improvements in wet gas meters.

1914. G. W. Petter and T. D. Galpin. Improvements in printing presses.

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1915. W. A. Vérel. Improvements in the preparation of bones for manure.

1916. R. A. Brooman. Improvements in apparatus for preparing and spinning fibrous materials. (A communication.)

1917. J. J. O. Taylor. An improvement in the separation of silex and silicious matter from iron.

1918. H. Spratt. Improvements in revolving pistols and other fire-arms.

1919. Hon. W. Talbot. An improved cigar lighter.

1920. H. Parkes. Improvements in the manufacture of cylinders, and tubular or hollow bodies of copper, and alloys of copper or other ductile metals.

1921. E. Abbott. Improvements in ordnance and fire-arms.

1922. O. Maggs. Improvements in taps, cocks, or valves.

1923. R. S. Harvey. Improvements in apparatus for dusting vines, hops, and other plants and trees with sulphur, and other powder.

Dated Aug. 23, 1859.

1925. P. F. C. de la Salle. A new method of arranging the keys on the fingerboards of pianos, organs, and other similar instruments.

1927. T. Fry. The application of enamelled slate to the new purpose of lining, panelling, or otherwise facing the internal or external walls of houses, public buildings, and edifices generally.

1929. O. Maggs. Improvements in apparatus for weaving straw, rushes, and other materials into fabrics.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

1942. M. Billing. An improved mode of ornamenting and finishing certain articles of hardware. Dated Aug. 26, 1859.

1944. M. J. Stark. Producing a new chemical or artificial manure from bones, and all such animal and fatty matters. Dated Aug. 26, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Sept.* 6, 1859.)

1019. W. Dicks and W. Hopwell. Boots and shoes.
1035. J. Holmes. Boots and shoes.
1044. W. Mackenzie. Printing impressions.
1053. G. Pearson. Trenails.
1068. N. Libotte. Steam brake.
1069. N. J. Holmes. Electric telegraphs.
1070. E. Lardenois. Pulp. (A communication.)
1071. T. Clarke. Sheaves or pulleys.
1077. J. W. Welch. Dressing yarns.
1078. H. Bosshard. Motive power.
1081. T. Smith. Cultivating implements.
1085. E. Francis. Treatment of tea.
1092. T. H. Arrowsmith. Carding engines.
1100. D. Moore. Dressing types.
1106. T. W. Miller. Generating steam.
1115. R. Mushet. Cast steel.
1122. H. Turner. Steam-engines.
1123. J. F. Allender and D. Rowley. Shears.
1150. R. Mushet. Puddling iron and steel.
1151. R. Mushet. Iron.
1154. W. E. Gedge. Steel. (A communication.)
1161. G. G. Bussey. Carrying cartridges.
1182. H. Clarke. Mill stones. (A communication.)
1183. M. Henry. Mariner's compass. (A communication.)
1197. W. Clark. Knitting machines. (A communication.)
1251. W. C. Cambridge. Thrashing and winnowing.
1560. N. Ardaseer. Steam boilers.
1617. W. Robinson. Cask-washing machines.
1645. H. Davies. Soap.
1654. T. Wright. Permanent way.
1661. J. Combe. Hackling fibres.
1718. J. Hartley. Steam-engines.
1778. E. Merrell. Washing and cleansing.
1808. R. T. Pattison. Dyeing fabrics.
1822. J. Cunningham. Jacquard apparatus.
1836. J. Cannon. Washing machines. (A communication.)
1856. W. White. Sociable carriage.
1860. W. De la Rue and H. Müller. Treating wax.
1909. H. W. Harman. Steam-boilers.
1944. M. J. Stark. Manure.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 31, 1859.

441. S. T. Cooper.
546. J. T. Carter.
553. J. W. Harker and J. K. Field.
554. E. Roche.
560. H. Brown.
566. J. D. Dougall.
573. C. F. Dennet.
576. R. A. Brooman.
579. J. M. Dunlop.
582. F. W. Parker.
588. R. Leake and M. Sykes.
592. W. Palmer.
594. W. Gossage.
595. J. Aspinall.
599. J. L. Jullion and G. Piric.
601. A. Booth and A. Booth, jun.
603. G. Twigg.
610. J. A. Williams.
612. J. R. Nicholson.
626. R. Hellard.
645. C. H. Hurst.
653. W. Clark.
657. W. Robertson and J. G. Orchar.
706. W. C. Cambridge.
709. W. Hudson and C. Catlow.
721. W. A. Gilbee.
754. H. Rigby.
780. W. Mossman.
800. A. V. Newton.
818. W. E. Newton.
830. A. Paget.
935. J. Luis.
993. J. Wotton.
1060. J. Holroyd.
1410. F. Puls.
1420. F. A. T. de Beauregard.
1497. R. Smith.
1521. R. Hornsby, jun.
1561. L. L. Tower.
1598. J. H. and T. Nalder.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2016. J. Blake and F. Maxwell.
2037. J. Apperly.
2038. P. J. Guyet.
2046. E. P. Spiller.
2054. E. and G. P. Leigh.
2062. Earl of Aldborough.
2064. J. B. Dancer.
2068. W. S. Mitchell and C. M. E. Gärtner.
2070. R. Wilson.
2076. S. W. Park and E. S. Ells.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Sept. 2, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
235	1 5	247	0 3	260	0 3	272	0 5	285	0 3	297	0 6
236	0 7	248	0 3	261	0 3	273	0 3	286	0 3	298	0 3
237	0 5	249	1 7	262	0 8	274	0 10	287	0 3	299	0 3
238	0 6	250	0 7	263	0 3	275	0 3	288	0 3	300	0 3
239	0 3	251	0 3	264	0 3	276	2 10	289	0 6	301	0 4
240	0 3	252	0 8	265	0 10	277	0 3	290	0 8	302	0 7
241	0 3	253	0 3	266	0 5	278	1 0	291	1 0	303	0 5
242	0 7	255	0 5	267	1 1	279	0 3	292	0 3	338	0 7
243	0 3	256	0 10	268	0 3	280	0 3	293	0 3	351	0 3
244	0 3	257	0 3	269	0 10	281	0 9	294	0 10	...	...
245	0 3	258	0 9	270	0 4	283	0 5	295	0 7	...	...
246	0 6	259	0 10	271	0 3	284	0 6	296	0 11	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

GAS-WORKS, *Blackburn.*—For the erection at No. 2 station, Addison-street, of a circular Ashlar stone tank, the diameter of which to be 112 feet, and 30 feet 6 inches in depth, including also dry well, river and retaining walling in connection with same. Plans, specifications, and conditions at the Company's office, Jubilee-street. Tenders, 26th September, to C. Parkinson, Esq., Chairman to the Blackburn Gas Light Company.

DIKES, *Scotland.*—For building about 200 roods of dikes, on the lands of Holeshiel, in the parish of Humbie, East Lothian, according to specifications with Mr. Hyslop, tenant at Hobshiel. Estimates to Messrs. Lawse and Bonar, W. S., 15 York Place, Edinburgh (who will also show the specification) September 20.

TILES, *Scotland.*—The magistrates and town-council of Forfar require the following tiles,—70,000 pipes and collars of 1½-in., 600 yards of 3-in. tile, 800 yards of 4-in., 1,400 yards of 6-in., 200 yards of 8-in., and 300 yards of 10-inch. Tenders to Mr. George Patterson, Superintendent, Forfar, September 14, with specimens. The whole to be delivered by the 1st of January next, and delivered at Forfar, or the Southmuir of Forfar.

CAST-IRON WATER-PIPES, *Ilfracombe.*—Contract No. 1 for 200 tons of cast-iron water-pipes. Contract 2, for the supply of sluices, hydrants, &c. Contract No. 3, for excavating the ground, and laying 5,300 yards of water mains. Contract No. 4, for construction of a covered reservoir, &c. Drawings and information at offices of Mr. Langdon, Solicitor, Ilfracombe, or at the office of Mr. Whitehead, County Surveyor of Somerset, Weston-Super-Mare. Duplicate copies and forms of tender at either of the above offices on payment of 10s. 6d. for contracts No. 1 and 2, and £1 1s. for Nos. 3 and 4. Tenders to September 19th.

COPPER SLIPS. *India Board.*—Conditions on application at the Secretariat office up to the 13th inst., where proposals before 11 a.m.

DRAINAGE AND WATER WORKS, *Hants.*—For carrying on Drainage and Water Works at Fareham, Hants. The works will consist of about 4½ miles of Stone Pipe Sewers, Deodorizing Tanks, &c., and about 5½ miles of Iron Water Mains, Water Reservoir, Pumping Engines, &c. The contract for the pumping engines will be let separately. Plans, &c., Mr. E. Rutledge, Engineer to the Fareham Local Board of Health, Quay-street, Fareham. Tenders, R. Porter, Esq., Chairman of the Board, September 14.

CHURCH, *Horncastle, Lincolnshire.*—For the restoration and reseating. Drawings, Mr. Nicholson, Churchwarden, and at office of Mr. Christian, architect, 10 Whitehall-place, London, S.W. Tenders to September 30.

SEWERS, *Greenwich.*—Also a reservoir and pumping station, engines, machinery, &c. Plans at office of the Metropolitan Board of Works, No. 1 Greek-street, Soho Square. No date given.

RESTORING CHURCH, *Lincolnshire.*—For restoring and reseating the old parish church of Horncastle, Lincolnshire. Plans, &c., until September 20, Mr. H. Nicholson, Churchwarden, and at the office of the architect, Mr. Christian, 10 Whitehall-place, London, S.W. Tenders, September 30, Chairman of the Church Committee, Vicarage, Horncastle.

CHAPEL, *Southport.*—Drawings, office of Messrs. Hayley and Sons, architects, Cross-street, Manchester. Tenders to September 20th.

PARSONAGE HOUSE, *Amblecote, near Stourbridge.*—Plans, office of Mr. J. M. Gething, Dennis Park, Prierley-hill. Tenders to Rev. J. M. Grier, Stourbridge, to September 19th.

WORKHOUSE, *Swansea.*—The time has been extended to the 14th inst. Whole or any part of works. Lithographed bills of quantities prepared by Messrs. Pearson and Doughney, surveyors, 9 John-street, Adelphi, London, may be obtained either at their offices or at the workhouse, Swansea. Tenders to clerk to guardians, to 5 Fisher-street, Swansea.

HOTEL AND TAVERN, *London.*—On the Vauxhall gardens estate. Plans and particulars at the office of Mr. W. W. Munford, architect, 21 Lincoln's-inn-fields. No date given.

WORKSHOPS, *Dublin.*—For the erection of workshops and other buildings on the premises of the North Wall Graving Dock, conformably to the specifications, &c., to be seen at the Ballast Office, of the Corporation for Preserving and Improving the Port of Dublin, where also printed forms of tender. Proposals to Mr. Wm. Lees, secretary, September 29.

SCHOOL-ROOM, &c., *Hants.*—For the erection of a school-room, with quarters for schoolmaster and schoolmistress, Christchurch Barrracks, in the county of Hants. Plans, &c., Royal Engineer Office, Gosport, to September 17. Tenders, War Office, Pall Mall, September 19.

DESIGN FOR GUILDHALL, *Cambridge.*—A premium of £50 will be given for the best, and £100 for the second best. Printed particulars at office of the town clerk, Cambridge. Designs to October 31st.

PLANS, &c., FOR CEMETERY.—Including roads and approaches, two chapels, gates, lodge walls, &c., premium, £15 for the best plan, and £10 for the next, to be left at office of Mr. A. D. Bartlett, clerk to the burial board, Abingdon, to September 21st.

SURVEYING, *Brecon.*—For making a survey and plan of the town of Brecon, on a scale of five feet to a mile, for the purposes of the Public Health Act, 1848, and of the Local Government Act, 1858. Printed terms, &c., Mr. Kirk, surveyor to the board. Tenders, S. B. Evans, clerk to the board, September 14.

IRONWORKS MANAGER.—Small ironworks. Apply by letter to Mr. R. Bewley, Stoke-on-Trent, stating salary and reference to last place.

WIRE DRAWING MANAGER.—A thoroughly practical man, well qualified to manage a wire drawing establishment. Address, T. 41, *Journal* office, Birmingham.

PRICES CURRENT OF METALS.

London, 9th Sep., 1859.

		£ s. d.		£ s. d.	Dis. p. ct
IRON, Rails in Wales and N.					
of England	pr. ton	6 0 0	to		nett
Welsh Bars, in Wales	"	5 17 6	"	6 0 0	2½
Staf. Bars at the Works	"	7 0 0	"	7 10 0	"
" Hoops	"	8 0 0	"	8 10 0	"
" Sheets, Singles	"	8 10 0	"	9 0 0	"
" Nail Rods	"	7 0 0	"	7 10 0	"
" Boiler Plates	"	8 10 0	"	9 0 0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2 12 3	"	2 12 6	nett
Do. No. 1, Good Brands	"	2 12 0	"	2 14 6	"
Scotch Bars	"	7 10 0	"	8 0 0	"
Swedish Bars, in London	"	12 0 0	"	15 0 0	2½
COPPER, Sheet and Sheathing	per lb.	0 0 12			"
Tough Cake and Tile	" ton	107 10 0			"
Best Selected	"	110 10 0			"
Australian	"	110 0 0	"	110 10 0	"
South American	"	103 0 0			"
Yellow Metal Sheathing	per lb.	0 0 10			2½
STEEL, Swedish Keg	pr. ton	19 0 0			"
" Faggot	"	24 0 0			"
TIN, English, Block	pr. cwt.	6 16 0			"
" Bar	"	6 17 0			2½
Foreign, Banca	"	7 3 0			nett
Straits	"	7 0 0			"
TINPLATES, Charcoal, I.C.	per box	1 12 6	"	1 13 6	"
Coke, I.C.	"	1 6 6	"	1 7 6	2½
LEAD, Pig, English	pr. ton	22 10 0	"	23 0 0	"
" Spanish	"	22 0 0	"	22 10 0	"
Sheet	"	23 10 0	"	24 0 0	"
SPELTER, on the spot	pr. ton	20 15 0	"	21 0 0	nett.
for arrival	"	21 0 0	"	21 5 0	"
ZINC, English, Sheet	"	26 0 0	"	27 0 0	1½
QUICKSILVER	per btl.	7 0 0			1½

REMARKS.—Business is at the moment extremely limited, with no alteration of prices worthy of remark.

LAWRIE AND HAGGER, Metal Brokers.
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 16, 1859.

THE GREAT EASTERN.

MONDAY, Sept. 12, 1859.

In the late passage of the Great Eastern from the Thames to Portland, with the terrible episode of a deadly explosion, there is much that seems to require our attention. The remarks which we transmitted from the ship for publication in our last number will have acquainted our readers with the prosperity and promise of the journey from Deptford to the Nore. Our present observations will therefore be directed to what happened during the completion of the passage from that point. And in carrying out our design we shall not enter upon any detailed narrative of that eventful trip. The rapid run to the Downs against a driving wind—the steady progress down the Channel through a gale which no other vessel faced—the joy and confidence with which all on board beheld the mastery man's genius had at last gained over wave and storm—then, the sudden explosion, the crushing down of the funnel, the rushing of the steam, the bursting up of the saloon, the alarm of fire, the activity of the officers, the steadiness of the passengers, the rescue of the scalded firemen, the devotion of the surgeons, the gradual return of confidence, the continuance of the voyage, the deaths of the sufferers, the arrival at Portland, the greetings from all around the ship, the silence of all within her—all these things have been faithfully and ably told by the special correspondents of the daily press, and need no repetition here. But connected with these occurrences there were others which fall within our professional sphere, and which, if they are not dealt with efficiently here, will probably not be dealt with efficiently at all. To these, then, let us turn.

And first, let us state that the cause of the explosion which occurred has not been correctly described, we believe, by the correspondents of the daily press. It is quite true, as has been said, that the vessel which burst was formed by the uptake or funnel on the inside and by a casing on the outside; and also that while the primary object in forming this chamber was to prevent the heating of the saloons, a further advantage was gained by feeding the boiler from the water which the chamber contained. This water, being supplied to the chamber cold, and drawn off when heated by the waste gases passing up the uptake, first had the effect of keeping the water-casing cool, and afterwards (when heated) was readily converted into steam in the boiler. So far the newspaper accounts are correct. But when they proceed to tell us that "the safety of the whole affair depends upon "the stop-cock which lets off the water into "the boilers being watched with unremitting "vigilance," and that "the neglect of this for "half-an-hour would allow steam to generate "in the casing, which would then, in plain "terms, become *a gigantic boiler, without a* "*valve* or any means of letting off its steam "save by blowing up"*—when, we say, they tell us this, and add that it was the neglect of turning the aforesaid stop-cock that occasioned the accident, they fall into error. The fact is, the "gigantic boiler" was not without a valve for letting off any steam that might be generated in it; on the contrary, it was furnished with such a valve, or rather with a tap, and this valve or tap opened into a small stand-pipe which was led up by the side of the main blow-off steam pipe of the boiler. Why the pipe alone was not sufficient, and why it had a tap fitted to it we cannot divine. But such a tap was fitted, and unhappily, on the occasion in question, it was either closed or left closed—by whom, or by whose dire neglect, the inquest upon the dead alone can be expected to reveal—and, consequently, when the engineer ceased to feed from the chamber, steam was generated and found no escape. Hence the accident which all men must deplore!

* The *Times*, Monday, Sept. 12, 1859.

And before proceeding further, let us do an act of simple justice to Mr. Scott Russell, by preventing a misapprehension which may easily arise. It is thought by some that the responsibility of the arrangement above described rests with that gentleman, as the builder of the paddle-wheel engines; the more so because a similar arrangement was excluded from the boilers used for the screw-engines of Messrs. Boulton and Watt. But this opinion is utterly false. We have proof as positive as can be desired to the effect that for the arrangement in question Mr. Russell is not in the remotest degree responsible. It was adopted by the Company on the recommendation of their own engineer, and was carried out by the Company in entire independence of Mr. Russell as the builder of the paddle-engines. We are the more anxious to enforce these facts, because those engines themselves—by far the largest in existence, and for which Mr. Russell is solely responsible—are unquestionably one of the most magnificent and successful features of this magnificent and successful ship. On the whole journey from Deptford to Portland, the astonishing ease, the constant uniformity, in a word, the absolute perfection with which those huge machines worked, excited the unceasing admiration of some of the foremost engineers in the whole world, several of whom were on board. When this is understood, and when it is further remembered that the noble hull, which withstood the tremendous shock of that great explosion absolutely unharmed, was also the work of the same man, all will feel how unfair it would be to detract from the credit of such successes by any error on the point in question.

Nor let us be content with doing justice to one individual. Let us do it also to the Company's engineer, by saying that nothing within our present knowledge places the responsibility of the late accident upon him. The arrangement of water-casing described may be, and we believe is, a bad and dangerous one; but, let it be observed, the thing itself was not in this instance the cause of the disaster. It was either the unwise adoption or the bad management of a mere detail—the valve or tap—that caused the explosion, and no evidence has yet been produced to show who was guilty of that unwise adoption or that bad management. This we laboriously endeavoured to ascertain on board the ship after the accident, but without avail. Clearly, however, the Company's engineer *may* be entirely free from blame in the matter. At the same time, as other dangers attend the use of the feed-water casing, we hope it will be altogether done away with in the Great Eastern for the future.

And now, before we turn from this subject of the explosion, let us advert to certain circumstances which followed that event, and which reflect great discredit upon some few of the passengers who are pleased to call themselves engineers. Some of the morning papers have printed the following document, which was issued before the company left the ship in Portland harbour on Saturday last. It runs:—

"Great Eastern Steamship,
"Portland Harbour, 10th Sep., 1859.

"Yesterday, at six p.m., an accident occurred on board the Great Eastern. The feed-water casing of the foremost chimney collapsed, owing to some neglect. Several stokers are seriously scalded; three since dead. No passengers injured. The ship and machinery are uninjured except main cabin fittings which are damaged. The working of the engines continued, and the ship proceeded uninterruptedly on her voyage to Portland.

"J. SCOTT RUSSELL, "J. E. MCONNELL,
"R. P. BRETON,
"— BERRETON,
"F. P. SMITH,
"W. SMITH,
"W. WOLLASTON BLAKE."

It is incumbent upon us to record the history of this very ridiculous production—ridiculous because while it pretends to be a professional document, and bears the names of men all of whom are either real or pretended engineers, it does not state a single fact that was not known to every soul on board the ship long before it appeared. The manner of its concoction will be gathered from the following statement:—Up to the time of the explosion, the success of the Great Eastern was felt by all on board to be fully assured. The rate at which she travelled, with engines at half-speed only—her perfect steadiness in heavily-rolling seas—the ease and readiness with which she answered her helm—the absence of all vibration in her splendid saloons—all these things, and some others, had made it plain that in all her mechanical features the vessel was a complete triumph. When the explosion came, a brief, but strong revulsion of feeling ensued. In accounting for this let us state our own personal experiences in the matter. About a dozen passengers, including Mr. James Nasmyth, the celebrated engineer, Mr. M'Connell, the locomotive engineer, Lord Alfred Paget, three or four literary gentlemen, and ourselves were right forward in the bow, sitting in the shelter of the topside; and having decided that the ship was mechanically a success, were about to discuss her commercial prospects. Lord Paget was uttering the last word of a sentence when a loud report, and a fearful throb through the ship beneath us, in an instant turned all our eyes aft. They were so turned only to behold the foremost funnel fly upward, followed by a cloud of steam driving the wreck of the grand saloon before it. Our first impression was that the boiler itself had burst, but something in the sound of the report made us think that the bottom of the ship had successfully resisted the shock. Of this we could not, of course, assure ourselves until considerable time had elapsed. Being situated before the scene of the explosion, with a high wind driving aft, there was nothing to prevent our rushing at once to the spot. This we accordingly did, in sufficient time to hear the first cries of agony, and of fire also, from below. Steps were at once taken to rescue the firemen from the stokehole; but ere more than two or three of the unfortunate men were brought up (in a condition which we need not describe here) our attention was called off by an excessive activity at the ship's side. This arose from an attempt which some of the riggers were making to lower a boat—whether to save a frightened nobleman, as some say, or to rescue a man who had leaped overboard, as others say, we cannot positively state. But we at once saw that the paddle-wheels were still going, and that the boat was being lowered immediately in front of them. One word whispered in the ear of Captain Harrison sufficed to have this monstrous folly checked, and the boat restored

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to its place. The removal of the hysterical wife of a director, who was rushing wildly in the thick of the turmoil screaming for her son, with the restoration of both son and husband to her, and other circumstances of the kind, varied the business of the moment, but need no record here. A considerable time—nearly a quarter of an hour—elapsed before either the Captain, Mr. Russell, the Chairman of the Company, or any other official person of note on board, became positively assured that there was nothing to apprehend from fire. There was no panic, or anything of the kind, so far as we observed—no considerable fear, even; but that further danger was supposed to exist for the time we have named is, we believe, quite true. Moreover, until it became known that there were no less than three medical men on board many thought it the duty of those in charge to take the ship into the nearest port; but after this was known, we heard nothing more upon the subject—except from the gentlemen of the press, who naturally enough would have been glad of an early opportunity of making the occurrence known to their respective journals.

Now, from what we have said, as well as from what the newspaper correspondents have said before us, it will be seen that a disastrous "blow-up" occurred. Evidences of the force by which that blow-up was effected were to be seen as soon as the excitement had subsided; first, in the utterly crushed-up condition of the up-take or lower piece of funnel within the casing, and, secondly, in the fact that this mass of metal, weighing a ton or two, had been blown bodily up from below. Equally strong evidences were to be seen in the lower parts of the ship. That the delight which pervaded the minds of all on board up to the moment of the explosion was now succeeded by a general gloom will be readily believed; and it will also be readily understood that none felt really more depressed than the Directors of the Company, to whom the commercial success of the vessel was of the greatest moment; but, like men of business, they—and especially Mr. Campbell, the Chairman—at once set about considering how the best of a bad thing was to be made. The persons with respect to whom they of course became deeply solicitous were the "gentlemen of the press"—chiefly those of the daily press. We had representatives of the *Times* and half-a-dozen other daily papers on board, and as the despatch of telegrams announcing the accident to the world, and also of papers describing it to the world, rested with these gentlemen, very much depended upon the impressions produced upon their minds. In order to modify those impressions—in so far, at least, as an accurate statement of the facts of the case in a scientific manner could modify them—the Chairman and his colleagues determined upon appealing to a scientific man to make such a statement. Accordingly Mr. M'Connell, the locomotive engineer, was requested to prepare himself for the purpose. This he did, and at 11 o'clock on Friday night—five hours after the accident—the representatives of the press were assembled in the Chairman's cabin to receive his statement.

Now, Mr. M'Connell's duty in the matter should have been plain enough to him. It was, undoubtedly, to have stated as accurately as he could the nature of the apparatus which had produced the mischief, and to have shown, as nearly as he was able, the cause of its failure. He might then with truth have said that the apparatus which had burst formed no integral or necessary part of the ship—that there was but one other of a like nature on board, and this could readily be removed—that the bottom of the ship had sustained the shock without the least injury, thereby showing wonderful strength—that notwithstanding the alarm of the evening, the ship had been in no sort of danger from fire—that the mischief was really circumscribed within very narrow limits—and that altogether, although the disaster was to be deeply regretted on account of the sufferings and deaths occasioned by it, the inference to be drawn from a survey of the vessel was, that the hull of the Great Eastern had borne unharmed an explosion which would in all probability have sent any other ship to the bottom. All this might have been said, and the only effect produced would have been that of helping the gentlemen present to publish a dispassionate account of what had transpired. There would have been nothing in it to offend either their pride or their good sense.

But Mr. M'Connell—with whom, for some mysterious reason, Mr. F. P. Smith got associated in the business—acted quite otherwise. It will scarcely be believed, but it is nevertheless true, that, in his first words, he said he "desired to disabuse the minds of the gentlemen present of the belief that an explosion "had taken place." "There has been," said he, "no explosion, but only a collapse of a water "vessel." When it is remembered that correspondents of the press almost invariably consider themselves thoroughly independent, honourable, and excessively clever fellows, the effect of Mr. M'Connell's announcement may be imagined. It was, of course, met not only with stout resistance, but with derision; and was followed by an hour of most unprofitable talk, ending with the promise of a report signed by Mr. M'Connell and Mr. F. P. Smith in the morning. On our part we opposed this proceeding, urging the production of a report for which Mr. M'Connell, or some other engineer alone, should be responsible, or else of a report from a committee formed of several of the scientific men on board. It should be remembered that we had Mr. Nasmyth, Mr. Appold, and other eminent men on board the ship; and there can be no doubt that had the object of the proceeding been fairly and justly carried out, we should have had a truly scientific report framed before we left the ship. As it was, a draft of a statement even more absurd than that afterwards produced was brought forward, but was withdrawn on the opposition of a literary gentleman, who pronounced one of its clauses "a lie," and most of the others unfair. Finally, the precious document printed above was produced, and signed by some who would sign anything to get their names in print—men who will have a finger even in a dirt pie—and also by Mr. Blake and Mr. Russell, whose names were afterwards put to it, probably to save trouble, and because the paper meant nothing. We state all these facts only for the sake of denouncing them; we state them only that we may follow them by saying that, from first to last, Mr. M'Connell and his officious colleagues on this occasion, did nothing but degrade science and put really scientific men to the blush. The whole of their proceedings, from the moment when reference was first made to them until we left the ship, were in the highest degree discreditable to them as professional or scientific men. We should say this had we been entirely unsupported in our opinions; but we say it all the more readily because the really scientific men who were on board are looking to us for a firm protest on the subject.

Having disposed of these scientific (!) proceedings, let us now remind our readers that the disaster of Friday evening last in no way detracts from the intrinsic merits of the Great Eastern, or lessens the success which her builder has achieved. What her full speed will prove to be cannot be foretold; her trial trip to Cherbourg will have that to decide. That trip will also have to determine by what expenditure of fuel—and generally with what degree of economy—her full speed is to be attained. But when it is remembered that on her way round to Portland the paddles where at no time permitted to make more than 8½ revolutions per minute or her screw more than 30, and that she nevertheless attained a speed of more than 12 knots against a strong head wind, we have good grounds for expecting great things of her when she shall be allowed to do her best. It should be remembered that those extravagant expectations—of 22 and even 24 knots per hour—which we so often hear of on all sides in connection with this subject, have never proceeded from persons authorised to speak upon the subject. Mr. Scott Russell modestly names 15 knots has a fair speed for her; and when her power is compared with that of other vessels there is really no reason for calling this too low an estimate. But it is already pretty certain that she will considerably exceed it; let us hope she may. But what she is able to do in respect of speed must of course depend, to a great extent, upon the capabilities of her screw engines, and we are sorry to say we feel rather doubtful as to them. They are unfortunately horizontal engines, and very similar to those fitted by Boulton and Watt in screw ships of war. For such ships it is, of course, absolutely necessary to keep the engines low, and there is good reason therefore for adapting horizontal engines to them. But there was no kind of necessity for fitting such engines in the Great Eastern. We should have very much preferred to see her furnished with engines of the form now largely in use on the Clyde, the plan of which may be said to be a modification of Mr. Nasmyth's hammer engine. In the arrangement to which we refer the cylinder is placed above the screw shaft, and from the piston rod a long connecting rod extends down to the shaft. A light hollow frame carries the cylinder, and a cross-head on the piston forms a guide, sliding up and down between the opposite sides of the frame. The hollow frame itself forms the condenser. Engines of this construction work with great smoothness and sweetness—more than can ever be hoped for from the screw engines of the Great Eastern—and such engines might have been adapted to her with the utmost convenience. It must also be admitted that the present engines manifested much uneasiness on the trip to Portland—an uneasiness which we sincerely hope may not reappear on the next trial.

Several of those writers for the daily press who have most admired the steadiness of the ship on her last week's voyage, seem to imagine that when, by the breaking of the steering lines, command of her was temporarily lost off Beachy Head, she rolled and pitched very heavily. This was not so. A real and manifest motion was undoubtedly imparted to her when she fell off from the wind, but it was so slight that it would scarcely have been noticed at all in any other vessel. For our part we are quite convinced, from the experience of last week, that the Great Eastern, if properly handled, will disappoint no one in the matter of steadiness in a seaway. Our meals were taken throughout the journey down Channel without our being once reminded, by any movement of the service, that we were on board a ship at all,—and yet we were really in the midst of high winds and turbulent seas. We must add to all this the perfect ease and readiness with which this huge monster steers, in

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order to fully appreciate her qualities as a sea-going vessel.

WEDNESDAY, Sept. 14.

In the evidence given at the inquest on Monday last, as reported in the morning papers, the accuracy of our former remarks (written on Monday) is fully established. It appears that the tap and stand-pipe were really fitted as we said, and the difficulty we had in accounting for the existence of a tap in such a pipe is removed by the statement that it was put there to enable the engineers to test the funnel-casing by hydraulic pressure. It is therefore pretty evident that the cause of the accident will ultimately be traced to some individual or individuals. We account for the mistake made by the newspaper writers in their accounts of the accident by assuming that they mistook the top of the length of casing which was blown upon the deck for the top. This is certainly what some persons did—a Metropolitan Member of Parliament, for instance, who was on board, and who displayed great skill and ingenuity in discussing with us the cause of the accident; and this, probably, is what the gentlemen in question did also.

It would also appear from the evidence given by one of the witnesses on Monday last that Mr. Scott Russell had charge of the boilers at the time of the accident. If he had, it cannot be supposed that an engineer taking temporarily the general control of a ship's boilers is to be held responsible for the condition of a tap which was "boxed up" or cased in many days before, and which, as a matter of course, should have been open, and afforded no sort of indication that it was not so. But we believe it to be altogether a mistake to suppose that Mr. Russell had anything whatever to do with the charge of the boilers on the trip. What he took upon himself—in our own hearing, in the first instance, as it happens—was the duty of communicating between the pilot or captain and the *engine-rooms*, in order that no bungling or risk might happen in consequence of imperfect or contradictory instructions reaching the engineers in charge of the paddle-wheel engine and the screw engine respectively. For this purpose he took his station upon the paddle-bridge, and stuck to it—incessantly from London to the Nore, and all but as incessantly from the Nore to the Downs, all the while the ship was under weigh. How it is possible for any one to suppose that a gentleman stationed there, and having charge of the telegraphs to both engine-rooms, can have been at the same time responsible for the details of the various boilers also, passes our understanding. We believe the witnesses must have been altogether mistaken on this head, and look anxiously for further intelligence on the subject.

THURSDAY, Sept. 15.

We have already guarded our readers against accepting the statements made by the witnesses at the inquest on Monday (supposing them to be correctly reported in the *Times*) as altogether fair and true. As matters advance, the necessity for caution in this respect appears to increase; and we begin further to fear that we must look to other newspapers rather than to the *Times* for full, and even for fair, reports of what transpires at Weymouth. In confirmation of this we would remind our readers that, in the absence of Mr. Scott Russell on Monday, the witnesses spoke and the *Times* reporter reported in such a manner as to indirectly but seriously implicate that gentleman. In the *Times* report of to-day not a word appears to counteract the impression thus produced; nor is Mr. Russell, although present yesterday, represented as expressing any dissatisfaction with Monday's proceedings. But when we turn to a "penny paper"—the *Morning Star*, which has reported upon the various features of this case with singular moderation and fairness—we find that (although the fact is suppressed in the *Times*) Mr Russell did object to the evidence given on Monday, or rather to the endeavours which the Company appear to be making to colour the facts of the case, and said "he was decidedly at "issue with the Company upon some points re-"lative to the inquiry."

If we may be allowed to offer a suggestion to the Company we would advise them—and especially their young and inexperienced solicitor, Mr. Leverson (or Levy-son, as we think the correct name is)—not to run to excesses through an undue anxiety to protect the Company at the expense of the illustrious builder of the ship, or of any one else. It is perfectly evident from the *Morning Star's* report of this day that the coroner is already alive to their danger in this respect, and has offered a gentle warning, which we hope the solicitor will avail himself of—witness the following conversation:—

A Juryman: Mr. Scott Russell I suppose is aware that the imputation is that the man who lengthened the stand-pipe screwed in the tap of the water-casing, and so left it.

Mr. S. Russell: Yes; but I think it will be shown in evidence that previous to the sailing of the vessel, that cock was found open. I shall be happy to attend to any intimation from the jury as to the production of any other witnesses.

In reply to another question from a juryman,

Mr. Russell said that Mr. Dixon, the superintending engineer, would be in readiness to give evidence on Saturday.

The Coroner: Have you many witnesses to call, Mr. Leverson?

Mr. Leverson: As the case at present stands, it appears clear that, unless Mr. Scott Russell puts a different construction upon the facts to that which we have put upon them, none of the company's servants are at all to blame for this unfortunate catastrophe. At present I shall not feel it necessary upon the part of the company to call any witnesses whatever.

The Coroner: On the part of the court I can inform you that the first witness I shall think it necessary to call is Mr M'Lennan.

Mr. Leverson explained that he was quite ready to produce any witnesses whom the coroner and jury thought ought to be examined. All that he meant to say was, that he did not intend to volunteer any evidence. He had endeavoured, and should endeavour, to show that the company were in no way responsible for this deplorable accident.

The Coroner: And I presume that Mr. Scott Russell will endeavour to show that the responsibility does not rest upon him.

Mr. Newman: Mr. Scott Russell will endeavour to elicit the whole facts of the case.

Mr. Russell: All that we wish to know is, who was the man who shut the cock which caused the explosion?*

In point of fact we think it time the "Company" had given up their personal interference in the ship—time that the captain took charge of her, and held himself and his officers responsible for all that transpires in her. No confidence will be felt by the public at large until this is done. Meanwhile we may look to the resumption of the inquest for interesting information. What we suspect will be found out is, that Mr. Russell, as we before said, took charge of the *engines*, and of them alone; but now that life has been lost and expense incurred by an explosion in the *boiler* department, an attempt is being made to show that he took charge of that department also. But we have already stated why we believe this was not the case, and we have no doubt that the attempt is based upon either a sad mistake or a gross subterfuge: time will show which.

But whoever had general charge of the boilers, it is pretty evident that not he, but "the man who shut the cock which caused the "explosion," is the blameable person; there is little need, therefore, for wrangling on the general question. As long as steam boilers are used we shall be at the mercy of mechanical workmen, and even of labourers; and this accident appears at present to be an instance of the terrible neglect of which such men, as well as others, are at times guilty.

* The same report appears, we find, in the *Morning Chronicle* and other papers.

THE ACCIDENT ON BOARD THE GREAT EASTERN.

THE following account of the inquest held at Weymouth on the bodies of the men who were killed on board the Great Eastern is condensed from the reports published in the *Times*. Those parts only which have little or no professional bearing are omitted. There is a great deal of obscurity in some of the statements of the witnesses, but as we were not in attendance at the examination we cannot say whether that obscurity arises from the imperfection of the report or not

TUESDAY, Sept. 13.

The inquest was commenced on Monday morning on the bodies of five men, all of whom lost their lives by the late explosion. It was held at the Town-hall, at Weymouth, before Mr. Henry Lock, the Coroner for Dorset.

The jury having been sworn, and having viewed the bodies,

The first witness examined was James Briscoe, the junior engineer of the paddle-engine department, who said that it was his duty to attend to the direction of the engineer in charge of the paddle-engines on duty, and to render assistance under their direction. He was told not to meddle with or make himself responsible for any of the cocks or valves. The duty assigned to him on the morning of the explosion was to attend the boilers and keep a proper supply of water in them. He had charge of the donkey-engine which pumped into the boiler; it was out of order, and did not perform its duty satisfactorily. He stood by one of the donkey-engines in No. 1 stokehole all day to keep it doing its work. That was on the starboard side of the ship. The donkey-engine on the port side of the ship in the forward stokehole had broken down. One minute before the explosion Mr. M'Lennan, the chief engineer of the ship, came down to witness, and looked to the saturation of the water in the boilers, and said, on leaving, that everything seemed right, and again cautioned witness not to meddle with any of the cocks or valves unless told by the engineer in charge of the paddle-engine department. Mr. M'Lennan left the place, and witness resumed his place by the donkey-engine. Shortly after the explosion took place, filling the stokehole with hot air and steam, witness came up the fore stokehole ladder. Noticed, while on the lower deck, that the inner and outer casings of the funnels were burst asunder, and that the whole of the cabins were destroyed on the lower saloon. Knew that the bursting of the water-heater round the forward funnel caused the explosion.

Examined by Mr. Leverson.—He remembered Mr. M'Lennan calling the engineers and stokers together on Tuesday last. Mr. M'Lennan told witness not to meddle with the engines or boiler, but to obey the orders of the engineer in charge of the paddle-department; that the engines were in Mr. Scott Russell's hands, and that he had supplied the engineers to attend them himself. Mr. Dickson, Mr. Russell's foreman, assumed control in the paddle-department; the explosion was confined to the funnel casing, which was for heating the water before going into the boilers, and also for keeping the saloon cool. The boiler would under ordinary circumstances be fed with water from the water-casing. At the time of the explosion, the boilers were not being fed from the casing, which was evident from the low temperature of the water going into the boiler. They had ceased to feed the boilers from the water-casing, he believed, to get a greater amount of water into the boiler. If the water-casing had been regularly kept supplied with water, and a continual

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flow in and out, the accident would not have happened. There were two stand-pipes to the water-casing, which, if open, would have prevented it. When the accident took place he had saved himself from being scalded to death by throwing himself down in the stokehole and covering his face with his hands. Witness knew that the engines were under the charge of Mr. Russell. Mr. Russell was on the bridge giving orders to his men below.

The Coroner asked the solicitor to the company whether any one was in attendance on the part of Mr. Scott Russell?

Mr. Leverson stated that there was no one.

Mr. Brereton, one of Mr. Brunel's principal engineers, was called to give evidence as to the probable cause of the accident. He stated that Mr. Brunel intended to accompany the ship on the trial trip, but in consequence of his illness witness accompanied the ship on his behalf. The accident occurred at six p.m. on Friday afternoon, when the ship was off Dungeness. When the explosion took place witness was near the paddle-boxes. The foremost funnel was blown up above the deck, immediately followed by a shower of splinters and pieces of glass. Went forward and found the funnel lying on deck in two parts, and on looking down the gratings leading to the boiler-rooms heard men crying for help and water. A good many of the passengers were there at the time, the fire hoses were laid on, a supply of water obtained to extinguish any fire that might have occurred; men then went below and brought up the wounded. As soon as the confusion was over examined the broken funnel on deck. On the following morning, according to the direction of the chairman, witness, with other engineers on board, examined the place where the explosion took place, to make a report as to the cause of the accident. Witness was accompanied in his examination by Mr. M'Connell (the engineer of the North-Western Railway), Mr. Scott Russell, Mr. Smith (the inventor of the screw propeller), Mr. W. Smith (a civil engineer), and Mr. Bates, who represented the firm of Boulton and Watt. Witness and those with him came to a conclusion as to the cause of the accident. The double-funnel casing was not always applied to other steam-boilers. The fact of the woodwork around the funnel being blown away led witness to see the cause of the accident without the drawings or explanations. They ascertained that the funnel was double for 40 feet of its length, the inside being 6 feet diameter, and the outside one 7 feet, leaving a space of 6 inches between the two all round. The water was contained between the two; the explosion took place about half-way down, near the lower deck. The inner casing was collapsed, and the outer one burst out. The object of the casing was to prevent the water being led direct to the boilers. There was an apparatus provided to prevent any excessive pressure accumulating in the water-jacket. This apparatus consisted of a "stand-pipe," which was carried to near the level of the top of the funnel, and communicated with the water-jacket, constituting a safety-valve. Being open at the top, as soon as the pressure increases it runs out of the "stand-pipe." The height of the column of water regulated the pressure in the jackets. From inquiry they learned that the feed water for the boiler was sent direct to the boiler without passing through the funnel, as the donkey engines did not work satisfactorily; one of them being disabled, the other had to do the work of two. That accounted for the fact of the communication between the boilers and the casing being shut off. An explosion ought not to have occurred if the "stand-pipe" was in operation. Their attention was called to the state of the stand-pipe, and they found at the bottom of it a plug capable of being turned. It was shut off, leaving no vent for the steam generated in the case. If the "stand-pipe had been in operation, or if the feed was continued through the jacket, the explosion would not have occurred. The steam must have gone on generating till the cylinder burst. No one seemed to know how, when, or by whom the cock was shut. Two or three days before the ship sailed, the "stand-pipe" not being high enough, a piece was added to it, so that up to that time the cock must have been open. It was supposed to have been closed by some workman for some purpose, and not to have been again opened.

By a Juror.—There was no safety or other valve to show there was pressure in the cases, as the pipe should always be open. Mr. Dickson was the engineer under Mr. Scott Russell directly responsible for the making and working of the engines. The engineer believes the cock never was opened from the time of leaving the river. If the cock had been taken off the accident could never have happened. The cock was put on to test the cases by hydraulic pressure, and had not been removed. The cock could not have been closed by the force of the explosion, or, indeed, witness could not conceive the accident occurring.

The court then adjourned to 9 o'clock on Saturday morning. The jury and the Coroner proceeded to examine the part of the ship where the accident occurred.

WEYMOUTH, WEDNESDAY, Sept. 14.

To-day, at 2 o'clock, the adjourned inquiry was resumed. The investigation appeared to excite no great amount of interest, and the court was almost empty throughout the entire proceedings.

Mr. J. Scott Russell, in compliance with a wish expressed by the Coroner, came down from town to attend the inquest.

Mr. John Dickson, foremen to Mr. Russell, and under whose superintendence the machinery of the paddle engines was fitted, was also present, and Mr. M'Lennan, the chief engineer of the Great Eastern.

Mr. Newman (of Freshfields and Newman) attended to watch the case with Mr. Scott Russell. At the commencement of the proceedings Mr. Leverson, the solicitor to the company, said he wished to correct an error which had appeared in some of the papers to the effect that he (Mr. Leverson) had stated at the previous inquiry that Mr. Scott Russell had had ample notice to attend the opening of the inquest, but had not done so. In fact, what he had stated was exactly the reverse, namely, that Mr. Scott Russell had had no notice of the inquiry; that he was at the time in London, on the company's business, and could not possibly have been in attendance.

After a few words from Mr. Scott Russell, who explained the cause of his unavoidable absence [and, as reported in the *Morning Star*, added that "he was decidedly at issue with the company upon some points relative to the inquiry"],

The Coroner said that, on the opening of the inquest, he had at once considered that it was a case which ought to be adjourned, in order that the jury might have the assistance of some of the surveyors from the Board of Trade He had accordingly communicated with the Board of Trade, and received a letter in reply the previous day which stated that it was impossible that Captain Robertson, the Surveyor-General, could attend the inquiry before Saturday next. He, therefore, thought that, under those circumstances, it would be most advisable that the jury should have the benefit of the experience of those officers, and, with their permission, he would adjourn further proceedings till Saturday morning at nine o'clock. He (the Coroner) trusted that both the company and Mr. Scott Russell would be ready on that occasion with any evidence which could throw the smallest light upon the causes which had led to so disastrous an accident.

One of the jury said that they hoped every effort would be made to discover the man who had turned off the cock or valve which led from the stand-pipe into the stokehole.

Mr. Scott Russell said it would be proved by witnesses that the cock of the valve was open on Tuesday, and when the vessel left the river on Wednesday.

Mr. Leverson intimated that the company were in no degree responsible for what had taken place, and the evidence adduced had established this on the company's behalf. He had no desire to call further evidence unless wished for by the court.

The Coroner said it was most likely the jury would like to examine Mr. M'Lennan the chief engineer.

The inquiry was then adjourned till Saturday morning.

The Special Correspondent of the *Times*, who is now at Weymouth, states that "the repair of the damages inflicted by the explosion has already commenced, Mr. Scott Russell having contracted to restore the whole for 5,000*l*. If it should turn out that either of the forward boilers has been injured, 5,000*l*. will hardly suffice for the entire restoration. From the fact of there having been no escape of steam from either of the boilers at the time of the explosion, when there was a pressure on each of 22lb., it is believed that they have escaped without material injury. The mere joinery of the cabin fittings and the redecoration of the grand saloon can, and doubtless will, soon be completed. With the ironwork, however, it is a different affair. All this must be executed in London from the working drawings of the vessel, and sent down piecemeal by rail to Weymouth, where it can be bolted together on board the ship. Mr. Scott Russell's contract is to finish the whole ship in her former state as she left the river within three weeks."

HOW TO MAKE A RIFLE BARREL.

THE barrel of a rifle when turned and bored to its finished dimensions is so different a thing from what it was originally in the hands of the smith that its intermediate stages of manufacture may well be described. The problem which has to be solved by the workers at Enfield, and other places which contract with that vast establishment is, how to convert plates of the finest Wedgebury iron, 13 inches long, 9·16 inches thick, and having bevilled edges, which make the sides vary in width from 5¼ in. to 5 in. respectively, into a slight but strong tube capable of withstanding the shock within it of innumerable discharges of gunpowder, and of directing unerringly a bullet of lead to a mark 1,000 yards distant from its muzzle.

The plate or "skelp" of iron intended for conversion into a barrel has, in the first instance, an almost white heat given to it, and is then passed between a pair of corrugated rolls, the upper roll having semi-circular projections running latitudinally around it, and which fit flutings sunk into the lower roll. The effect of this pinching is to bend the barrel plate longitudinally. It is next passed between double flutings on the same rolls, and this operation makes a cylinder of the "skelp," minus the welding. The bevilled edges are made, however, to approach each other for this purpose, and welding is the next process. A rod or maundril of iron about ⅜ ths in diam. is passed through the orifice of the "skelp," and it is then placed in a reverberatory furnace. When sufficiently hot for the purpose, it is taken to the rolls for welding and drawing out to length and shape. These rolls and their framings resemble much those ordinarily used for rolling iron. There is, however, an important difference—the grooves or flutings upon them are turned out eccentrically with the axis of the rolls. This is for giving the requisite taper from muzzle to breech of the barrel. When the heat is sufficient, which of course practice enables the workman to decide, the barrel is withdrawn by aid of the maundril from the furnace, and laid on an iron rest in front of the mill. The operator now watches carefully his opportunity to thrust it into one of the grooves of the running rolls at a moment when they are prepared to administer the proper pinch for tapering the barrel. A series of these grooves, each smaller than the other, now receives the gradually welding and elongating barrel, until the gauged recess in the rolls finishes the rolling process. In this last time of passing between the rolls the maundril is turned round differently, and

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a guard attached to it coming in contact with the rest, a boy stationed at the back of the rolls receives in a pair of tongs the barrel only, the maundril remaining behind for another operation. This boy, whilst the heat is still upon the barrel, roughly straightens it upon an iron surface. After this it is placed under a power press provided with beds or swedges of the same length as the barrel, the lower of which is horizontal and stationary, and the upper one rising and falling by means of a central joint, which allows it to "give" to any irregularities. Supposing all to be sound and satisfactory so far, the next operation will be that of "lumping," or having the cone seat welded on. This is rather peculiar, and demands especial observation. A nice heat is taken on the breech end, and a piece of iron of sufficient dimensions is put on the particular place where it is needed by hand. Then another heat is taken on all together, and whilst in a soft state a maundril is driven into the breech end. It is next placed between dies of the form required, and repeated blows from a trip hammer brings the cone to its proper shape.

This machine is of American invention, and it is very effective. Its principal parts are of wood. The hammer itself, or lever, is hung on journals, the end carrying the die being by far the heaviest. A disc, fitted with a number of studs on its outward diameter, lies at right angles with the other end of the lever. The disc revolving rapidly, and fitted with a fast and loose pulley for disengaging, &c, carries with it the triangularly-formed studs—of which, indeed, there are 12 of about 4 inches in length, and they strike the end of the hammer lever. It is needless to say that the hammer itself, therefore, rises and falls, rapidly, too, on the principle of the tilt hammer. In fact, at Enfield this hammer, with its die face—so to speak—falls upon the cone seat of a rifle barrel at the rate of 300 times per minute. Annealing is the next thing to be done, and it must be done carefully. The atmosphere must be jealously excluded, and charcoal used to prevent decarbonisation. Great care is necessary with regard to the degree of heat applied in annealing. The desideratum is to make the material "mild" and easy to work without deteriorating its strength or quality.

The succeeding process is that of rough boring. This, too, is accomplished at the Government works in a machine of American origin. The machine is so contrived as to bore four barrels at once. Perhaps a brief description of it may not be uninteresting. Four spindles, geared together, are driven by a pulley with a loose one beside it. These spindles rest horizontally on a frame supported by two standards, the frame also forming a trough, and holding an abundant supply of cold water for keeping the barrels cool whilst being bored. The boring "bits" resemble twisted augers, the cutting portions being about six inches in length, but welded to rods sufficiently long to pass completely through the barrel. The ends of these bits are secured into the sockets of the spindles, the barrels being fastened horizontally in the machine. A self-acting feed causes the bits when in motion to take a cut completely through the barrels. The operation is repeated, and then the barrels are taken out and straightened by blow of hammer. The outside of the barrel next claims attention, and it is turned in a peculiarly constructed self-acting slide lathe, with a copying bar attached to produce the required figure. The tool rest of this machine is so devised as to carry two cutters, one in front, the other opposite and behind. One of these is to "rough," whilst the other takes a light and smooth cut. In order to prevent chattering a very solid bearing is made to follow the cutters closely. The turning properly done, another boring becomes necessary —the all-important one. Now one barrel at a time only is operated upon, the machine being a horizontal one fitted with a bracket which fits the barrel on the outside. The "bits" used for this boring are square, the sides being carefully ground on a stone. It does seem strange that so simple an instrument—by the aid only of the truthful eye of a workman—should be sufficient for the purpose of making an accurately parallel hole through a rifle barrel; but it is so. One end of the square bit fits a socket, and is made to revolve to the tune of something like 300 revolutions per minute. On two sides of the squares of the bits strips of deal wood are placed, and it is astonishing to note the perfect truthfulness attainable by these primitive means. Of course the gauge is put in requisition when this boring, for which oil is the lubricator, is completed.

The chamber at the breech-end is next attended to, and a rose-faced pin-drill is the implement used for boring it out. Afterwards the breech-pin is secured to it, and then the proving is commenced. The inspector, whose duty is momentous, at this stage, too, steps in and examines every part of the workmanship and material. Passing this ordeal, the barrels are now ground on an ordinary grindstone to a gauge. Sundry operations follow, the lump or cone seating is shaped up by a cutter, and brought nearly to a finish—the breech-pin is also now brought into form by similar means. Indeed, revolving cutters or "mills" are the universal tools at Enfield, whilst the variety of names given to them for identification is amusing.

The barrels are next drilled and tapped to receive the nipple, then clamp-milled about four inches up from the middle, and on each side of the foresight, so that the bayonet may fit well. The barrels are now drawfiled from end to end. Gauges are next applied once more to every part, and the rifling must be performed.

The machines used at Enfield for cutting the three rifle grooves in each barrel are of Belgian manufacture, strange to say, most of them having come from Liège. To describe them without diagrams is difficult. Their beds resemble somewhat those of the ordinary slide-lathe. On each bed there is a slide working backwards and forwards, after the plan, almost, of a planing machine. This slide is provided with a pinion which gears into a rack, the end of which slides on a radial bar set at the required angle from the central line of the machine. As the slide is made to traverse slowly along the bed, the radial bar is made to advance or recede according to the direction in which the slide is going, and of course gives a gentle twist to the pinion which has the cutter bar attached. This latter requires some explanation. It is composed of a bar of steel passing clear through the barrel, and filling it. The end remotest from that fixed in the pinion of the slide has a kind of mortice cut in it, with an inclined plane acting against a similar one on the other. The incline on the cutter has the point of a fine threaded screw bearing against it. This screw is prevented from moving by a square rod into which it is fixed, and which slides through a disc at the extreme end of the machine. All the time the cutter is travelling, it leaves the screw, and, as a spiral spring now acts upon the end of the cutter opposite the inclined plane, the tendency must be to force it out, and make it wider at the breech-end to the extent mentioned in a former article of this Magazine (September 2nd). The cut *commences* at the muzzle, and the barrel is firmly clamped whilst the "rifling" is going on. At the breech-end there is an arrangement for setting the barrel into proper position for cutting the grooves at equal distances from each other. Supposing the spiral grooves or rifles to be now cut in a barrel, the next operation will be to remove the slight "burr" which the cutter, however clean it may have cut, will have inevitably left in its progress from muzzle to breech. In order to accomplish this the barrel is placed so that it cannot turn round, though it may be moved laterally. A leaden "lap" made to revolve at a very rapid rate is now introduced, and the barrel is made to slide to and fro upon the lap. The effect is to remove every vestige of wire edge which the cutter may have left, and to polish the interior of the barrel like a mirror.

Released from this machine, the barrel is next taken to the proof-house, where possibly the explosion within it of a heavy charge of gunpowder, and the propulsion through it of a bullet, may reveal some defect which will condemn it. If, on the contrary, it stands this test, it is passed forward to the machine or revolving cutter, which "mills" the fore-sight into shape. A little hand labour—such as removing by aid of smooth files any trifling imperfections left by the various machines—is now performed, and then comes the task of fixing the all-important "back-sight." This must be most carefully done, for accuracy of range and aim depends on this. The **V**, which is the centre point of this sight, must range exactly with the centre of the fore-sight, and both be central with the centre of the axis of the bore of the barrel. Without attending scrupulously to these points, indeed, the whole of the previous labour might be deemed as thrown away. Presuming that all has been satisfactorily done, from the bending of the "skelp" to the attaching of the back-sight, and that inspectors have pronounced it very good, the barrel has next to be *bronzed;* and in order to effect this, the exterior is made, in the first instance, to become oxidised, by application of water, and then to pass through a simple chemical process. Polished *over* the bronzing, it is now fit for its walnut-wood bed, and for the companionship of those component parts which go to make up the handsome weapon with which the various and happily increasing number of rifle club members are becoming familiar, but which we trust they may not be called upon to use hostilely. For much of the information in the foregoing paper we are indebted to the courtesy of C. F. Hayes, Esq., of the Small Arms Factory, Enfield.

INSTITUTION OF MECHANICAL ENGINEERS.

THE Annual Meeting of this body was held in Leeds, during last week, under the presidency of Mr. John Penn, of Greenwich. The first meeting was held in the Civil Court, at the Town Hall, on Tuesday, Mr. Penn presiding.

FILE-CUTTING MACHINERY.

The first paper was a description of Bernot's file-cutting machine, by Mr. Thomas Greenwood, of the firm of Greenwood and Batley, machine makers, Leeds. Mr. Greenwood alluded to the fact that whilst machinery had been introduced into most manual operations, file-cutting remained stationary. Various machines had been invented in America and this country, and large sums of money had been spent by manufacturers in Sheffield, but partly from difficulties, real and imaginary, and also from the opposition of the operative file-cutters, these experiments had failed up to within a recent period. So great were the prejudices of the operative file-cutters that they refused to teach the apprentices how to grind their cutting chisels until the last year of their apprenticeship, and the tariff of prices remain fixed, on the supposition that no improvement had taken place in the rolling of steel, thus entirely ignoring the progress that had been made; and forgers charged the same price for drawing the tang upon a round or square rod of steel for a parallel or equalling file as they did for forging a half-round taper file of the same length. The actual process of file-cutting, however, was one of the simplest description. It consisted in driving a chisel of suitable form and inclination to a small depth into the prepared surface of the blank, and steadily withdrawing it again. The difficulties to be surmounted were to present the blank perfectly parallel to the cutting edge of the chisel; to withdraw the chisel from the incision made in the blank without damaging the edge of the newly-raised tooth; to prevent a rebound of the chisel after the blow which drove the chisel into the blank before the next blow was struck; to give a uniform traversing motion to the blank, ensuring regularity in the teeth; to proportion the intensity of the blow to the varying width of the file, so as to give a uniform depth of cut; and to perform these operations at such a speed as to make them commercially pro-

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fitable. In most of the attempts which had been made the idea had been to construct an iron arm and hand to hold the chisel, and an iron hammer to strike the blow, but the vibration which attended this mode caused irregularity in the work, and a ragged uneven edge on the tooth. The slow speed, too, at which these machines were worked rendered them unable to compete with hand labour. In the machine invented by M. Bernot, of Paris, these difficulties were obviated. The blow was given by the pressure of a flat steel spring pressing upon the top of a vertical slide, at the lower end of which the chisel is firmly fixed The slide was actuated by a cam, making about one thousand revolutions per minute, thus obviating the vibration consequent upon the blow with an iron-mounted hammer. After explaining the machine more minutely, by means of diagrams, Mr. Greenwood remarked, with regard to the durability of the cutting chisels, that it was found that they cut five times as many files as could be cut by hand, without re-sharpening. In the files cut by this machine the teeth were raised with perfect regularity, and, consequently, when the file was used, each tooth performed its proper share of work; whereas, in hand-cutting, from the varying power of the muscles, especially towards the close of the day, it was impossible to produce such perfectly uniform work. Every description of round or half-round files was cut by the use of a revolving bed, and dividing apparatus for round and hand round files. The paper concluded by stating that a manufactory employing twelve of these machines had been established at Douai, in the north of France, and another at Brussels. A machine, which had been fitted up in the room, was then put into operation by means of manual power, which, however, could not give the full velocity, but notwithstanding this the work done was of a very satisfactory character, the files cut being the full-sized flat hand files. A discussion ensued, and in reply to Mr. Fothergill, Mr. Cowper, and others, Mr. Greenwood said that the relative cost of cutting the files, as shown by practice at Douai, was as 4d. per dozen to 2s. 8d. for manual labour, on a certain class of work, which left a large margin after the cost of the machine and power in favour of machine work. As to the durability of the files, it was decidedly greater than that of ordinary files. The difference of production was as ten to one, and the machine would last as long as ordinary complicated machinery. There was no difficulty in cutting round and half-round files. There was also an additional advantage in the equality of the work obtained. In hand labour it was found that the files made in the afternoon were not so good as those made in the morning, the muscles becoming relaxed, and the blow, therefore, less regular in force. It cut the taper files all one depth, but no doubt the pitch could be altered if necessary, by making the machine a little more complicated. On the suggestion of Mr. Maudslay, Mr. Greaves, who had charge of the machine, briefly addressed the meeting. He said that he had been engaged in file-cutting twenty-five years, and he was prepared to state that the machine would cut as good files as could be made by hand, if properly attended to. It was necessary, however, that the machine should be fixed, and not re-set every half-hour. The President then thanked Mr. Greenwood for his paper, and the discussion terminated.

ECONOMY AND DURABILITY OF STEAM-BOILERS.

The Secretary then read a paper by Mr. Longridge, of Manchester, on the "Economy and Durability of some classes of Steam-boilers." The paper was of a very elaborate character, requiring a number of statistics and diagrams for its illustration. With respect to the best surfaces for heating, Mr. Longridge said there could be no question that horizontal surfaces were the best for absorbing heat, but unless this heat were carried off, and accumulation prevented, the practical value of such surface for generating steam would be much impaired, and the plates speedily injured. Hence those surfaces were to be preferred which, combined with naturally good positions for absorbing heat, offered the greatest facility for circulation of the water. The paper concluded by remarking that great as had been the progress of late years in the construction of steam-engines, and the economical use of steam by working expansively, this had not been accompanied by equal progress in the construction of steam boilers; for, whatever might be the scientific knowledge in the latter branch of engineering, it was certainly not favourably exhibited in the generality of boilers in present use. On the contrary, the laws of combustion and evaporation seemed generally to have been almost entirely ignored, and waste of fuel and rapid deterioration of boilers had been the natural consequences.—Mr. Kitson briefly alluded to the importance of the subject raised by Mr. Longridge, and said that the time had come when more attention ought to be paid to the construction of their boilers. One great mistake which had hitherto been committed was, that persons purchasing boilers simply fixed the power and the amount per ton, without reference to the construction. This had, commercially, been really a great error, because if greater power were given to the boiler-maker, and a higher degree of intelligence brought to bear on the construction of boilers, the result would be to the benefit of the purchaser.—After some remarks from Mr. Goodfellow, of Manchester, with respect to evaporation, the President and Mr. Bastow made a few observations, and the discussion closed.—A vote of thanks was then passed to Mr. Longridge.

MORRISON'S DIRECT-ACTING STEAM CRANE.

The secretary then read an interesting paper by Mr. Morrison, of Newcastle-on-Tyne, descriptive of a direct-acting steam crane invented by that gentleman. For the usual complications of ordinary steam cranes, there was in this crane substituted a piston with a flexible piston-rod, working steam-tight through a stuffing-box in the top of the crane-post, passing over two pulleys, and forming the chain. By this arrangement the different movements of the crane were performed with the greatest facility and precision, the lifting being performed by the admission of the steam above, the piston forcing it down the cylinder or crane post to a distance equal to the lift required. It would lift 32 feet, swing round, discharge, and swing back to re-load, three times per minute. In other words, it would discharge three tubs of coal, of 2 tons each, in one minute. Comparing it with water, taking the latter at a pressure of 60 lbs. per square inch, and steam at 50 lbs., the writer said he had found that the cost of steam was but 4½d. per hour, whilst water would be 8d. The cost of a machine with boiler and steam-pump would be about 460*l*.—Some discussion took place with respect to the relative cost of hydraulic and steam cranes, after which a vote of thanks was passed to Mr. Morrison.

ALLAN'S NEW PRESSURE GAUGE.

The next paper read by the Secretary was one by Mr. Alexander Allan, on a new pressure gauge, invented by him. The principle of the gauge consisted in indicating pressure, either above or below that of the atmosphere, by the more or less compressed or expanded condition of a measured quantity of air contained within the gauge, This was acted upon by the pressure through water or other fluid contained within a bent pipe, which was attached at one end to the gauge, and at the other to the boiler or vessel containing the pressure to be indicated. The surface line of the water, as seen in a glass tube attached to the body of the gauge, indicated the extent of the pressure, on a graduated scale.—Several gentlemen expressed their favourable opinion of this gauge, one of which was exhibited, and a vote of thanks was passed to Mr. Allan for his paper.

HASTE'S SAFETY-VALVE.

The last paper read was one by Mr. William Naylor, of London, descriptive of Haste's safety-valve for steam-boilers, which was illustrated by a section of the valve, and a number of diagrams. We cannot give a description of the valve without diagrams, but we may state that the objects of the invention are to carry off the steam as fast as it is generated above the pressure the boiler is intended to work at; to be entirely out of the reach or control of any one to tamper with or overload it; and to be so arranged that in the event of the water getting low in the boiler, the valve shall blow off steam, and avoid the possibility of any explosion or injury beyond the burning of the plates if more water be not supplied.

A vote of thanks was accorded to Mr. Naylor, and the sitting terminated, the members proceeding to visit Messrs. Marshall's flax-mill, and other works thrown open to their inspection. In the evening of Tuesday a *conversazione* was held in the Victoria Hall.

The Second Meeting was held in the Civil Court on Wednesday. Mr. Penn again presided.

SUPER-HEATING OF STEAM.

The first paper read by the Secretary was "On the Application of Super-heated Steam in Marine Engines," by Mr. J. Penn, the President. The paper was of a technical character, but of great interest to practical men. The writer stated that an opinion in favour of super-heating the steam supplied to steam-engines had long existed, and it had been maintained that important advantages might be obtained from this principle, though until recently but little had been effected in its practical application. Super-heated steam seemed to have been first definitely tried by Mr. Thomas Howard, of Rotherhithe, about twenty-seven years ago. Considerable economy was effected, but the machine was too delicate in its construction to test the experiment properly (though it established the principle), and it was given up. Soon afterwards Dr. Haycroft, of Greenwich, took up the subject, and was convinced of its advantages. The importance of the principle was first impressed upon the writer many years ago, and he became satisfied, from the results of experiment and observation, that great advantages in economy of fuel might be obtained, the main question to be settled being whether it involved any serious practical objection from complication of apparatus, risk of derangement and failure, or difficulty in lubrication of the engine. Recent trials, made on a large scale, led the writer to the following conclusions:—That an advantage can be obtained from the use of super-heated steam, amounting to an economy of fuel of from 20 to 30 per cent. in marine engines; that a moderate extent of super-heating enables all the important advantages of the plan to be obtained; and that apparently nothing objectionable is then necessarily involved from extra wear and tear, risk of failure, complication of apparatus, or difficulty in lubrication. The real advantage in employing super-heating steam appeared to be in preventing the presence of any water in the cylinder of the engine, and ensuring that it should be occupied always by nothing but pure steam; making it a real steam-engine, instead of one working with a mixture of water and steam. In all condensing engines the interior of the cylinder, being open to the condenser during half the time of each revolution of the crank, was exposed during that time to the low temperature of the condenser, or about 125 degrees, with a vacuum of 13¼ lbs. per inch below the atmosphere, or 27 inches of mercury. There was, consequently, a rapid absorption and radiation of heat from both the sides and the end of the cylinder, thus cooling down the whole mass of metal. The steam admitted into the cylinder in the next stroke, at a temperature of 260 deg. if at 20 lbs. per inch above the atmosphere, coming in contact with these cooled surfaces, heated them up again, being robbed thereby of a portion of its heat; and the consequence was the deposit of a quantity of water in the cylinder, from the condensation of an amount of steam proportionate to the quantity of heat imparted to the metal of the cylinder. A portion of this water in the cylinder might be evaporated again into steam towards the end of the stroke, by carrying the

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expansion of the steam down to a sufficiently low pressure: but even then its effective value as steam in propelling the piston would have been lost during all the previous position of the stroke. Now, if as much heat be added to the steam, by super-heating it before entering the cylinder, as would supply the amount of which it was robbed by the cylinder, it would remain perfectly dry steam throughout its stroke, and not a drop of water would be deposited. This, the writer believed, was the mode in which the super-heating of steam acted in producing a saving of steam, and consequent economy of fuel, by preventing the extensive loss or waste of steam that ordinarily took place. The addition of 100 degs. of heat to the temperature of the steam insured the accomplishment of the desired object with steam at 20 lbs. per inch, as used in marine engines. The writer then proceeded into more technical details, reference being frequently made to the diagrams, and said, that having fitted the engines of the Peninsular and Oriental Company's steamer *Valetta* with super-heating apparatus (illustrated by diagrams), the experiments made gave a saving of 20 per cent. of fuel. These experiments were not complete, but they were entirely satisfactory as far as they went.—A very interesting though technical discussion ensued, in which Mr. W. S. Ward, Mr. Morrison, Mr. Cowper, Mr. Maudslay, the President, and other gentlemen, took part; after which a vote of thanks was passed to the President for his paper.

SUPPLYING LOCOMOTIVE TENDERS WITH WATER.

The Secretary read a "Description of Fryer's Apparatus for Supplying Locomotive Tenders with water," by Mr. James Fenton, of Low Moor. By this apparatus it is proposed to force water from tanks below the level of the lines into the tenders, by means of the pressure of condensed steam from the engines; and it was stated that the experiments tried in a large sugar manufactory at Manchester had been highly successful. The great value of the apparatus was where water could only be obtained at low levels, and it was said that there was greater protection from frost, the water being stored below the level of the ground. After a short discussion, in which Mr. Fryer explained the apparatus in a more popular manner, a vote of thanks was passed to Mr. Fenton for his paper, and to Mr. Fryer for his communication.

CONSTRUCTION OF STEAM BOILERS.

The Secretary then read a communication from Mr. B. Goodfellow, Hyde, "On the Construction of Steam Boilers."

IMPROVED RAILWAY BREAK.

The next paper read was by Mr. Alex. Allan, "On Increased Railway Break Power for Stopping Railway Trains." After referring to the importance of increasing the break power for stopping fast trains within a shorter distance than at present, the writer said that the subject of the paper was a plan for obtaining increased break power, by retarding the speed of the engine, by means of a throttle valve, placed in the exhaust pipe, which could be instantly closed to any required extent, so as to obstruct the exit of the steam from the cylinders, the regulator remaining open, at the same time that the exhaust steam was admitted to a small cylinder, the piston of which acted through levers on a break on the engine wheels. The break cylinder applied the breaks simultaneously to the leading and trailing wheels of the engine, and the driving wheels were at the same time retarded by the back pressure of the exhaust steam on the pistons, consequent upon the closing of the throttle valve in the exhaust pipe. The power of the break cylinder was limited, so as not to skid the wheels, in order to avoid wearing flat places on the tyres, and to produce the greatest effect in retarding the speed. A break power of from 14 to 22 tons could thus be obtained by the steam break alone. The retarding power of this steam break had been tried on the Scottish Central Railway with the most satisfactory results. A train consisting of engine, tender, and 11 empty carriages, weighing 85 tons, and going at a speed of 36 miles per hour, was stopped in 23 seconds, running 220 yards. In reply to an inquiry, Mr. Allan said the application of the break was so regulated as to prevent any shock.

STEAM CRANE.

The Secretary next read "A Description of a Steam Crane," by Mr. J. C. Evans, of London, which gave rise to some remarks by Mr. Maudslay, the President, and others, after which the President thanked Mr. Evans for his paper.

THE PUMPING-ENGINES AT ARTHINGTON.

The proceedings of the sitting were closed by a description of the pumping-engines at Arthington Water-works, communicated through the Secretary, but it contained no facts which have not already been made public.—Mr. Anderson then moved a vote of thanks to the President for his conduct in the chair, which was seconded by Mr. Fothergill, and carried by acclamation. At the close of the meeting the following objects of interest were exhibited for the inspection of the members:—A steam carriage for common roads at the works of Messrs. Witham, Kirkstall-road; Naylor's steam-hammer, Kirkstall Forge; two locomotive engines, with welded boilers, at the Midland Station; Aytoun's safety miners' cage, in a yard opposite to the Town Hall; roof and large bell of the Town Hall; Hattersley's type-composing machine, in the Victoria Hall; and Mr. James's machine for winding up clock weights, in the entrance to the Victoria Hall. The Members were taken by special train to the pumping-works at Arthington, after which they dined together in the Wellington Hall. On Thursday they visited Low Moor and Saltaire.

THE BRITISH ASSOCIATION.

ABERDEEN, WEDNESDAY, Sept. 14.

THE meeting of the British Association for 1859 commenced this evening in the new Music-hall. There was a very large attendance, and great interest attached to the meeting in consequence of his Royal Highness the Prince Consort being the president elect.

Professor Owen, on retiring from the chair, congratulated the members on the prosperous condition of the Association, and that it was presided over by his Royal Highness.

The Prince Consort, after taking the chair, delivered a very able address, which occupied 40 minutes in delivery, and was loudly applauded throughout.

Sir Benjamin Brodie moved, and the Lord Provost of Aberdeen seconded, a vote of thanks to his Royal Highness, which was enthusiastically passed by the large audience.

FLEET-STREET, THURSDAY AFTERNOON, Sept. 15.

We confidently expected to receive a report of the Prince Consort's speech from our correspondent in Aberdeen, in time for publication in this number; but it has not yet reached us, and as we have to publish at noon to-morrow, it is not possible to delay our Magazine further for it.

LIST OF NEW BOOKS.

Brown's Companion to the New Rifle Musket, 2nd edit., 2s. 6d.
Burnett's Tillage a Substitute for Manure, 5s.
English Cyclopædia, Knight's Arts and Sciences, Vol. II., 12s.
Grantham on Iron-ship Building, with vol. of Plates, 2nd. ed., 25s.
Laurie's Tables of Simple Interest from 2½ to 5 per cent., 24 edit., 21s.
Moor's The Ventilation of Mines, 5s.
Todhunter's Spherical Trigonometry for Colleges and Schools, 4s. 6d.

THE GREAT EASTERN—*Erratum*.—For the correction of an error in our last week's article on this ship, see the first paragraph of our "Gossip" of this week.

ON THE EARTH'S INTERNAL TEMPERATURE, AND THE THICKNESS OF ITS SOLID CRUST.

By WILLIAM HOPKINS, Esq., M.A., LL.D., F.R.S.*

IF we descend beneath the surface of the earth, and observe the temperature at different depths, it is found that within a depth ranging from 50 to 80 feet, the temperature changes periodically, being affected to that depth by the heat which the earth receives from the sun at different seasons of the year. The annual variation, however, becomes less as the depth increases, till at the depth above-mentioned it becomes insensible. At greater depths, the temperature is invariable at each point, but increases with the depth, at the rate on an average of 1° (F.) for a depth of between 60 and 70 feet. The best observations which have been made on this subject are those in deep mining shafts and deep artesian wells; the greater depth the more completely do anomalous influences counterbalance each other. The greatest depths at which such observations have been made in Western Europe, are at Monkwearmouth and Dukinfield, in this country; the Puit de Grenelle, at Paris; Mondorff, in the Duchy of Luxembourg; New Seltswerk, in Westphalia; and at Geneva. At the first two places the observations were made in vertical shafts of coal mines; the depth of the one at Monkwearmouth being upwards of 1,800 feet, and that at Dunkinfield upwards of 2,000 feet; and in both cases the observations were made while the workmen were sinking the shafts, and with every precaution against the influence of any extraneous causes which might affect the observations. The former gave an increase of 1° (F.) for every 60 feet of depth, the latter for about every 72 or 73 feet. The sinking of the Puit de Grenelle was superintended by Arago. The mean increase of temperature was 1° for every 60 feet. At Mondorff the bore was 2,400, being that of an artesian well; the increase was 1° for 57 feet. At New Seltzwerk the artesian well, penetrating to the depth of 2,100 feet, giving an increase of 1° (F.) for 55 feet. The average of these is very nearly 1° for 60 feet. Numerous other observations are confirmatory of those results, though observations at smaller depths present many anomalies indicating the operation of local causes.

If a sphere of very large dimensions, like the earth, were heated in any degree and in any manner, and were left to cool in surrounding space, it is shown, by accurate investigation, that after a sufficient and very great length of time, the law according to which the temperature would increase in descending beneath the earth's surface, within depths small compared with the earth's radius, would be—that the increase of temperature would be proportional to the increase of depth. This coincides with the observed law, if we neglect the anomalous irregular variations which are found to exist more or less in each locality. Now according to this law, the temperature at the depth of 60 or 70 miles would probably be sufficient to reduce to a state of fusion nearly all the materials which constitute the earth's external solid envelope; and hence it has been concluded, that the earth probably consists of a central molten mass as a fluid nucleus, and an external solid shell, of not more than 60 or 70 miles in thickness: and some geologists, desirous of rendering the conclusion the foundation of certain theories, have considered the thickness even less than that now mentioned.

This conclusion, however, rests on reasoning in which an important element is wanting. It involves the hypothesis that the *conductive power* of the rocks which constitute the lower portions of the earth's crust, is the same as that of the rocks which form its upper portion. This conductive power of any substance measures the facility with which heat is transmitted through it; and it is easily proved, by accurate investigation, that when the same quantity of heat passes through superimposed strata of different conduc-

* Authorised abstract of a recent lecture at the Royal Institution.

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tive powers, the increase of depth corresponding to a given increase of temperature (as 1°), is in any stratum proportional to the conductive power. Consequently, if the conductive power of the lower portions of the earth's solid crust be greater than that of the thin upper portion of it through which man has been able to penetrate, the depth to which we must proceed to arrive at a certain temperature (as that of fusion for the lower rocks) will be proportionally greater. The precise nature of the rocks situated at a great depth can only be judged of by analogy with those which are accessible to us; but those geologists who adopt the conclusion of the extreme thinness of the earth's crust, will doubtless admit that its inferior part must be of igneous origin, and must therefore be allowed to bear a certain resemblance to igneous rocks on the surface of the earth. Mr. Hopkins had recently made a great number of experiments on the conductive powers of various rocks. That of the softer sedimentary rocks, which are great absorbents of water, is very much increased by the quantity of moisture they contain; but taking chalk, one of the best absorbents, its conductive power, even when saturated, is not half so great as that of some of the igneous rocks on which Mr. Hopkins had experimented. Calcareous, argillaceous, and siliceous substances reduced to fine powder, stand, with reference to their conductive powers, in the order in which they are now mentioned, the conductivity of the first being the least; and when in a compact state, all that contributes to give a hard and crystalline character to the substance, and continuity to the mass through which the heat is conducted, increases the conductive power. These considerations lead to the conclusion that the conductivity of the inferior portions of the earth's solid crust must be much greater, and may be very much greater, than that of the less consolidated and mere superficial sedimentary beds. Moreover, the temperature of fusion of certain substances, as Mr. Hopkins had shown by experiment, is much increased by great pressure; and by analogy it may be concluded, that such would, at least in some considerable degree, be the case with the mineral matter of the earth's crust. The chalk is that formation in which the most numerous and some of the best observations on terrestrial temperatures have been made, and it would seem impossible to conclude from actual experiment and the considerations above stated, that its conductive power can exceed one-third of that of the inferior rocks, and may not improbably be a considerably smaller fraction of it. Now the increase of depth in the chalk corresponding to an increase of 1° (F.) is well ascertained to be very nearly 60 feet, and therefore the rate of increase in the inferior rocks must probably be at least three times as great as in the chalk, and may be very considerably greater still. Hence, supposing that the thickness of the solid crust would be about 60 miles, if the conductive power of its lower portion were equal to that of chalk, its actual thickness must probably be at least about 200 miles, and may be considerably greater, even if we admit no other source of terrestrial heat than the central heat here contemplated.

There is also another way of investigating the thickness of the earth's crust, assuming the whole terrestrial mass to consist of a fluid nucleus, inclosed in a solid envelope. If the earth were accurately spherical, instead of being spheroidal, its axis of rotation would always remain exactly parallel to itself, on the same principle as that on which the gyroscope preserves, in whatever position it may be held, the parallelism of the axis about which it rotates. But the attraction of the sun and moon on the protuberant equatorial portions of the earth's mass causes a progressive change in the position of the earth's axis, by virtue of which the North Pole, or that point in the heavens to which the northern extremity of the earth's axis is directed, instead of being stationary, describes a circle on the surface of the heavenly sphere about a fixed point in it called the pole of the ecliptic with a radius of nearly 23½°, equal to the inclination of the equator to the ecliptic, or the *obliquity*. The whole of this revolution is completed in about 25,000 years; but, as follows from what has just been stated, without any change, beyond small periodical ones, in the obliquity. A corresponding change of position must manifestly take place also in the position of the equinoxes, which have thus a motion along the ecliptic in a direction opposite to that in which the signs of the zodiac are reckoned, completing a revolution in the period above mentioned of 25,000 years. It is called *the precession of the equinoxes*.

This precessional motion has been completely accounted for under the hypothesis of the earth's entire solidity, and that of a certain law according to which the earth's density increases in approaching its centre; but some years ago Mr. Hopkins investigated the problem with the view of ascertaining how far the observed amount of precession might be consistent with the existence of a fluid nucleus. The result was, that such could only be the case provided the thickness of the solid shell were much greater than that which, as above stated, has been supposed by many geologists. The numerical result was, that the least admissible thickness of the crust must be about one-fifth of the earth's radius; but without assigning any great importance to an exact numerical result, Mr. Hopkins had a full confidence in the investigation, as showing that the thickness of the crust could not be so small as 200 or 300 miles, and consequently that no geological theory can be admitted which rests on the hypothesis of the crust being nearly as thin as it has been frequently assumed to be.

The influence of the interior fluidity on the precessional motion above described, is due to the difference between the motions which the attractions of the sun and moon tend to produce on a solid mass in one case, and a fluid mass on the other. It has been recently stated, as an objection to this investigation, that the interior fluid mass of the earth *may* move in the same manner as if it were solid. The only reply which could be given to such an objection was, Mr. Hopkins conceived, that it was mechanically impossible that these motions should be the same, though the resulting precessional motion for the solid crust, under certain conditions, to be determined only by the complete mathematical solution of the problem, might be the same as if the whole mass were solid. The effect of the attractions of the sun and moon also depends on the ellipticity of the inner surface of the solid shell; and it has been said that since that ellipticity depends on the law of the earth's density, which can only be imperfectly known, no result can be depended on which involves that ellipticity. This was not a correct statement of the problem. It was assumed in the solution referred to, that the ellipticity of the inner surface would depend partly on the law of density, and partly on the forms of the isothermal surfaces. Mr. Hopkins had supposed it possible, at the time he was engaged in this investigation, that a surface of *equal solidity* might approximate to a surface of *equal pressure*; he has now experimental reasons for believing that it must approximate much more nearly to an internal surface of *equal temperature*. Now, for depths greater, probably much greater, than those which have often been supposed to correspond to the thickness of the earth's solid crust, there is no doubt that the internal isothermal surfaces have a greater ellipticity than the external surface itself—a conclusion which is independent of the law of density. Hence, a like conclusion will hold with reference to the internal surface of the shell, if it approximate sufficiently to the surface, of equal temperature; and this is the conclusion most unfavourable to the thin shell supposed by some geologists. Restricting the interpretation, then, of Mr. Hopkins's results to the question, whether the earth's solid shell be as thin as some geologists have supposed, or at least several hundred miles in thickness? (and this is the only question of geological importance)—Mr. Hopkins denied the validity of either of the objections above stated.

Thus, both the modes of investigation which had been described lead to like conclusions respecting the least thickness which can be assigned to the solid envelope of our globe. It must be much greater than geologists have frequently imagined it to be.

THE NEW CALCUTTA MINT.

THE machinery for the new Calcutta Mint is rapidly approaching completion, and will be shipped for that place before the end of the year. We have no hesitation in saying, after a personal examination of the drawings for the building, and of the various mechanical appliances prepared, or in course of preparation by James Watt and Co., for the establishment, that this new money factory will, when completed, be the most extensive and perfect in the world. The designers of it, it is true, have had the advantage of inspecting all existing mints, and thus the opportunity of improving upon them. They have used that advantage with extraordinary effect, however, and have left apparently little for others to improve upon.

The space of ground upon which the machinery, on reaching India, will be erected is large, and the workshops and offices are in course of rapid construction. Two steam-engines of (we believe) fifty horse-power are intended to give motion to eighteen rolling mills of various sizes, for the breaking down and laminating of silver and gold bars. The rollers of these mills are of chilled cast-iron, the largest being 18 inches in diameter, and the smallest 10 inches. There will be eight cutting-out presses of great productive power, from the peculiarity of their make, and the rate at which they will work. What is called the drawbench will not, as in the British Mint, be used. It is considered that well-finished rolls carefully attended to, will produce work as accurate as that which is turned out by this expensive appliance, and we have little doubt of the fact. Twelve coining-presses, made to vibrate at the rate of 200 strokes per minute, and to produce coins as rapidly, *it is said*, complete the fitments of this mammoth Mint. The presses are to be impelled by compressed air acting upon pistons attached to their fly-arms, and working in iron tubes concentric with the vertical screw-pin to which the die is attached—an arrangement altogether new in money-making machinery, and now, therefore, to be put on its trial, except as experimentally at Soho for the first time. At a further period this remarkable work will obtain further attention at our hands, illustrative as it is of mechanical improvement and the march of civilization.

THE GREAT EASTERN.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Will you permit me through the medium of your excellent Magazine to put the following question to those gentlemen who are so very confident as to the perfect safety of the Great Eastern, viz., what will be the effect of and upon that noble vessel when her monster engines are suddenly and severally released from all resistance by the paddle-wheels and screw becoming alternately out of water, as must be the case when she is resting upon and running directly across and through the crests of water of more than 40 feet altitude, or rather, of 80 or 90 feet, including the depth of the trough of the sea between them? W. H. JAMES, C.E.

September 6th, 1859.

SPILL'S NEW MILL-BANDING. — Numerous readers having written to us for the address of the manufacturers of the new mill-banding described at page 152 of our Magazine for September 2, it may save trouble if we mention the address here; it is, we believe, Messrs. G. Spill and Co., 18 Bread-street, Cheapside, London, E.C.

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LAUBEREAU'S PATENT AIR ENGINES.

FIG. 1.

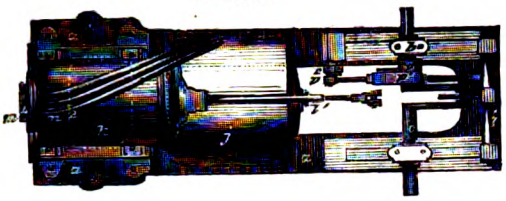


FIG. 2.

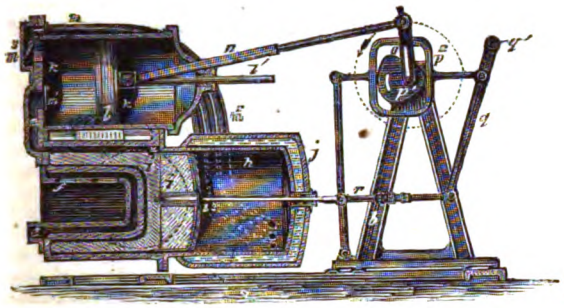


FIG. 3.

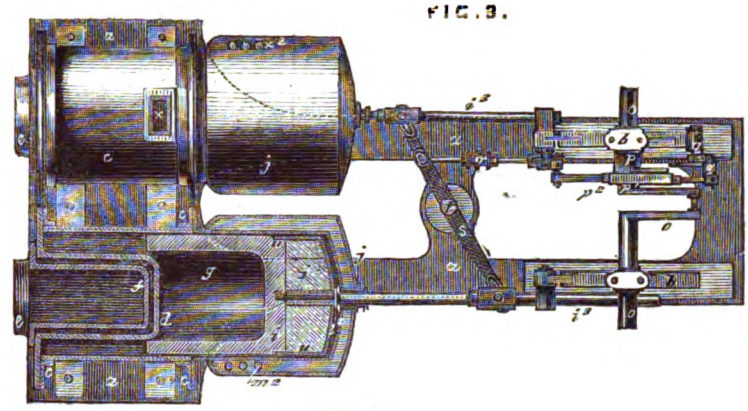


FIG. 4.

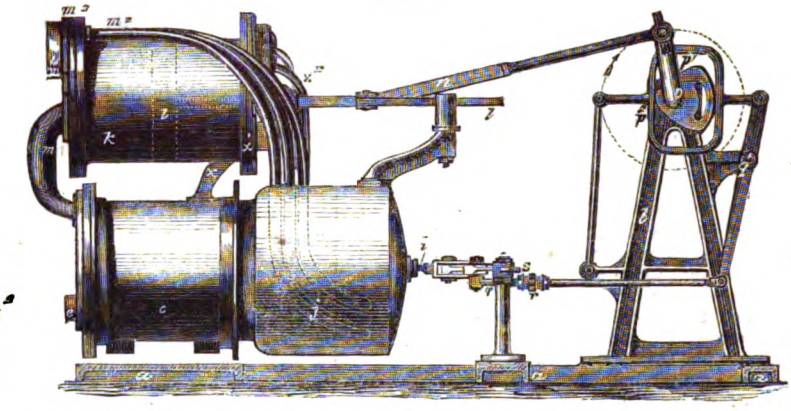
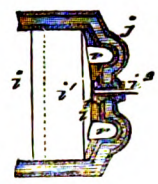


FIG. 5.



LAUBEREAU'S PATENT AIR ENGINES.

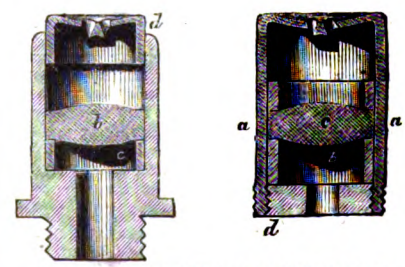
MR. J. LAUBEREAU, Civil Engineer, of Paris, has just completed a patent for "Improvements in Air Engines."

The invention consists in arrangements of machinery for producing the alternate expansion and contraction of air, and in causing the stroke of a piston to be effected by the expanded air, while the return is effected by the pressure of the atmosphere, aided by a partial vacuum obtained at the back of the piston. The patentee forms a heating chamber with double sides and communication between them, and by preference in the shape of a ∩, which is placed in a cylinder or chamber round the upper part of the sides, and at top of which is a chamber for containing cold water or other cooling agent. In the space formed between the sides of the cylinder and the sides of the heating chamber, he places a grooved piston of a ⊓ shape, and forms it of some metal of high-heat conducting power, such as bronze. This piston is so carried that it does not touch the sides of the cylinder nor of the heating chamber, there being space for a thin layer of air between it and them. On the top of this piston he forms a chamber, and fills it with some very bad conductor of heat, such as lampblack, and again places on the top of this chamber a cushion of cotton or other like non-conducting material. The piston chamber and cushion are all attached to a central rod, which works through a stuffing-box in the top of the cylinder and through the water space. The non-conducting chamber is kept from touching the sides of the cylinder, a pipe communicates from the bottom of the cylinder to the working cylinder, in which an ordinary piston is placed, and conveys the air to and from the working cylinder, and that in which the air is expanded and contracted. Connecting rods and other agents are employed so as to give motion to the piston in the expanding and contracting apparatus at the dead points of the working piston.

Fig. 1 is a plan of a single-acting engine complete, and Fig. 2 a sectional elevation. Fig. 3 is a plan of a double-acting engine, the cylinder being removed and one generator shown in section; Fig. 4 is a front elevation partly in section; and Fig. 5 a section of part of a generator relating to an improvement in the means of perfecting the vacuum. The same letters refer to like parts in all the figures. *a* is the foundation plate; *b b* are the side frames; *c c* are the external cases of fire-boxes; *d d* the fire-box covers; *e e* the smoke pipes; *f f* the fire-boxes; *g g* the hot chambers; *h h* the cold chambers; *i i* the travelling caps; i^1 i^1 the boxes containing non-conducting substances; i^2 i^2 the cushions or pads; i^3 i^3 the travelling cap rods; *j j* the external cases containing cold water or other cooling agents; *k* the cylinder; *l* the piston travelling in the said cylinder; l^1 the piston rod; *m* the hot-air pipe, the lower extremity of which is in direct communication with the hot-air chamber of one of the generators, and from which it is conducted into the cylinder at the back of the piston; m^1 the clack valve admitting the hot air, but intercepting the return of the cold or contracted air; m^2 the vacuum pipes communicating from the back of the cylinder to the cold or condensing chamber *h* of the same generator; m^3 the clack valve, allowing the egress of the condensed air; m^4 the box bolted to cylinder bottom, through which the contracted air circulates from the clack valve m^3 to the pipe m^2; *n* the connecting rod; *o* the main shaft and crank; *p* the cam plate keyed on shaft *o*: p^1 the cam bolted to the plate *p*; p^2 the cam plate or box; *q* the vertical oscillating lever; q^1 the fulcrum point on which the lever oscillates; *r* the rod connecting the lower extremity of the vertical lever to the lever *s*; *s* double horizontal lever communicating an intermittent reciprocating motion to the travelling caps *i i*; *t* the fulcrum on which the lever *s* oscillates; *u u* wheels attached to the sides of the caps *i i*, and on which they roll in order to diminish the friction; *x* a hot-air or pressure pipe, the lower extremity of which is in communication with the hot-air chamber of the other generator, and from which it is conducted into the cylinder at the front of the piston; x^1 a clack valve admitting the hot air, but intercepting the return of the cold or contracted air; x^2 vacuum pipes communicating from the front of the cylinders to the cold or condensing chamber *h* of the same generator, passing through the cooling agent contained in the case *j*; x^3 a clack valve allowing the egress of the condensed air; x^4 a box bolted to cylinder cover, through which the contracted air circulates from the clack valve x^3 to the pipes x^2.

The working of the engine is as follows:—Fire being lighted and the piston in the expanding chamber being drawn up, the cold air is driven out of the upper part of the expanding and contracting cylinder, and simultaneously the air in the space and the bronze piston between the fire-chamber and side of the cylinder become heated, and the air expanding rushes from the expanding chamber into the working cylinder, and drives up the working piston. Immediately before the working piston reaches the top of its stroke, the bronze piston has attained the end of its down stroke, and the air in the upper part of the contracting cylinder having become cool by contact with the cold sides and top thereof, a partial vacuum is formed, and atmospheric air entering through openings in the cover of the working cylinder by the aid of the pressure of the atmosphere aided by the partial vacuum, the return stroke is effected, and so on successively.

FIG. 1. FIG. 2.



COURT'S PATENT GAS-BURNERS.

MR. J. COURT, gas-fitter, of Brompton-row, Middlesex, has just patented a very simple but useful improvement in those gas-burners which have for their objects the better regulating of the supply of gas to the burner and economy of metal used in the construction. The invention con-

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sists in forming a chamber in the nib, and filling, or partially filling, the same with a number of layers of fine wire, wire-gauze, perforated plates, or other porous material, through which the gas passes. The progress of the gas is retarded and its pressure diminished; it also becomes heated in its course through the nib, and more complete combustion, and consequently increased illuminating power, are the results. He forms the chamber either by boring the nib at the bottom of sufficient capacity to receive the layers of wire or other material, and he then inserts a plug (previously drilled through for the passage of the gas) in the bottom of the nib, which presses on the material so placed, and confines it in position. Or the nib is first bored from the top, and after placing the material in it is held there by the tip (which may be of iron, earthen, or glass of the usual union jet or bat's-wing slit). Fig. 1 of the accompanying engravings is a sectional elevation of a nib complete, where the layers of wire gauze *b* are inserted through the top, resting upon a metal ring *c*; the tip *d* may rest on the wire gauze, or the wire gauze may be fixed in position as shown by a hollow tool. Fig. 2 shows a sectional elevation of another form of nib, *a*, *a* is the outer shell in which a cavity *b* is bored, the upper part of which may be filled with wire gauze or perforated plate *c*. One or two metal rings are employed to keep the wire gauze from shifting, and the whole is firmly secured by a screw plug *d*.

THE CORT CASE.

WE are glad to find that, in accordance with our announcement made a few weeks since, the Cort case has been taken up by Mr. Cobden, Mr. Fairbairn, and their Lancashire and Yorkshire friends. We find that Mr. Fairbairn's late letter to the *Times* has been made the basis of the new proceedings, for the carrying out of which a committee has been formed comprising Mr. W. Fairbairn, Mr. J. Whitworth, Mr. R. Cobden M.P., Mr. T. Bazley, M.P., Mr. J. A. Turner, M.P., and Ivie Mackie, Esq., Mayor of Manchester. The following statement has been published:—

"The immediate object of this fund is to co-operate with the iron and engineering trades of Great Britain for the support of the Cort family, consisting of a son and three daughters, the youngest of whom is seventy years of age. The inventions of Henry Cort for the manufacture of bar iron have reduced the cost of that most indispensable article, during the last seventy years, 66 per cent., as compared with the previous price of foreign iron. They have for the last twenty-five years greatly economised conveyance and transportation by railway and steam navigation, while the iron wire for telegraph conductors could not be made without the same inventions.

"The total value of cotton goods, thread, and yarn consumed and exported in Great Britain for ten years ending 1856, allowing for waste in spinning, and deducting cost of raw material, according to a table given in the *Encyclopædia Britannica*, vol. xiv., eigth edition, p. 255, amounts to more than £365,000,000 sterling, to pay all other expenses, wages, interest, profits, &c. What, then, must be the aggregate value for the last 58 years, which never could have been realized to the same extent had not the steam engine been made available for the purpose, during the whole of this period, by the inventions of Henry Cort.

"We, the undersigned, strongly recommend this subscription to all who feel as we do, the great value of Henry Cort's inventions, not only to the British nation generally for the last seventy years, out of materials abundant and previously useless in our native land, and by native labour, but more especially as regards the past and future trades of Lancashire and Yorkshire.

(Signed) "IVIE MACKIE, Esq., Mayor.
"RICHARD COBDEN, M.P.
"WILLIAM FAIRBAIRN, F.R.S."

The electric telegraph to Melbourne and Adelaide is in constant use, and affords a remunerative revenue. Indeed, the amount of business transacted has forced on the Government the absolute necessity of a second wire. Wires to Bathurst and to Maitland were in progress, and will shortly convey messages between those important towns and the Australian metropolis.

THE LOSS OF LIFE BY THE WRECK OF THE ALMA.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—In your impression of last week you have again done the State a service in directing public attention to the sacrifice of life by the wreck of the Alma through the neglect of the most ordinary precautions for its preservation at sea, and in consequence of which some twenty human beings who might be still living have been wantonly hurried into eternity. In doing this you again assert for suffering humanity its right to protection from those whose duty and position in the social scale constitute them its custodians and not its destroyers; and the remedy you suggest of putting captains and officers in charge of ships on their trial for manslaughter is the only one likely to induce a better state of things; for however the recitals of such catastrophes may excite our feelings, this process of reformation is far too tardy; and the stronger power of the law, and its rigid and certain application as you recommend, will be the only check to the constant repetition of such cases as that of the Alma. The dread of imprisonment, and the public shame and disgrace that must follow a man through life (who having fulfilled his term will still carry about with him, as it were, his moral ticket-of-leave), stigmatised as he would be under such circumstances as the cause of the death of some of his fellow-creatures through his wanton neglect, *must* have its weight. Repeatedly, when going down the river with ships "clearing out," have I heard the argument used by pilots to the "men on the look-out," as the most forcible they could advance to make them careful, that "they may be put in prison if any loss of life should happen through their neglect of duty." Already is this law enforced in the factory, the mine, and the railway, and the speedy punishment that follows a guard or overseer when a life is lost through carlessness has materially helped to diminish the aggregate mumber of casualties. Why should not the same consequences attach to captains and officers in charge of ships? Nor should this *criminal responsibility* be limited only to them. The Lord Chief Justice Clerk, when life was lost by the foundering of the Orion, on the coast of Scotland, summed up in these words: "That any person placed in a situation in which his acts may affect the safety of others must take all precautions to guard against the risk to them from what he is doing; and in the event of loss of life through any device resorted to for the purpose of economy, &c., *grave criminal responsibility would arise, as well to the captain who neglected to use all appliances in his power to keep the boats in proper order, as to the proprietor who should fail to have* supplied sufficient boats in the first instance, or refused proper allowance to have them maintained."

Now, the *Times* states that twenty minutes elapsed after the Alma struck before the first boat was got out and lowered, and then, that as there were *no thowl pins* in it, it was unmanageable, and *twenty lives were lost in consequence*. Now, whose fault was it that no efficient means of instantly lowering the boats was at hand, and no thowl pins in the boat when on the water? Nay more, how is it that the very circular of the Board of Trade to which you draw such prominent attention, "No. 51, 1857," and which I now give *in extenso*, was in this very case, as it has always yet been, "a dead letter." That circular directs that life-boats shall carry "*all requisite for use*," and that "surveyors are to refuse delarations in future in cases in which the life-boat is in such a position as not to be ready for use in an emergency, or in which efficient means are not provided for lowering it safely and expeditiously into the water." When such regulations as this are never enforced on owners before the ship sails, by officers specially appointed to see them carried out, and the Board of Trade winks at their neglect of public duty, is it to be wondered at that the captain does not trouble his head about such things as *thowl pins* when he is away at sea; and is it likely that one officer who may be subsequently sent to institute inquiry into the cause of of the loss of life that has resulted mainly through the neglect, moreover, of a brother officer to enforce proper regulations for its prevention, and which neglect is openly tolerated at head-quarters; I ask, is it likely that any punishment will follow? Take a case that occurred some time since within sight of our shores. One ship ran into another, and more than twenty minutes elapsed before the disabled one sunk, and seventy people were in consequence drowned (only one boat having been made available in that time); yet a simple comment that "it was a common thing for ships to carry their boats in-board," was all the official notice taken of as wanton an instance of wholesale manslaughter as any that the annals of our criminal records can show. With such a case before us is it to be wondered that the game of death goes bravely on, or that such catastrophes as the Alma's happen thousands of miles away at sea, when, under the very eyes of the officers here at home, the causes that lead to them are permitted to continue by the Government in spite of all law and justice?

Other criminals who destroy human life must pay the penalties for their misdeeds, but your owners, your captains, and your officers of ships drown their fellow-creatures by hundreds, and boldly stalk about in broad day-light with no other punishment than the troublings of consciences which have already had no influence whatever in guiding them to the just discharge of their duties to their fellow-men. Death caused by inadvertency, and death caused by violence, is the same in its consequence on its unhappy victims; and the men who murder their captain only bring about a like result with the captain who drowns his crew through wanton neglect of the means that might have saved them in the hour of need. Yet who ever thinks of calling to account the latter, whom the law has already stigmatised as *criminally liable*. Equal justice should meet out equal punishment, and be no respector of persons. The poor and ignorant seamen soon find out how the majesty of the law is vindicated. The little flies are caught, while the big ones break through its meshes that were never framed for their capture. The blessings of wealth, education, and position in society should teach us to set an example of obedience to the laws of our country, and not how to break them, more especially, where the poor and unprotected are the sufferers. Only let any one who reads this take the trouble to go through our docks and inspect a few ships "ready for sea," he need not be long finding thowl pins out, rudders with irons broken, and no yoke lines, oars anywhere, and boats themselves unfit for use. Instances like these he will find by scores; but one of punishment awarded for death caused through such neglect he must search our naval history in vain to find out.

It is a painful reflection that it should be so; but no regrets will find the remedy. The knowledge that punishment by imprisonment would follow every case of life lost through wanton neglect, affords the only hope of a change for the better; and it is the constant agitation of the subject by the press that can alone urge on justice to use its sword. Mercy in such cases to the guilty is only future death and suffering to the unprotected, for sparing justice breeds iniquity.

If those amongst our rulers who preach philanthropy and the exercise of the higher virtues to benighted niggers, and severe punishment to the wretches who enslave and destroy them, would only throw a few of the crumbs of their surplus benevolence to the poor British seamen and helpless emigrants and passengers, many a home would not now be wanting its mainstay and support; many a widow's heart would have been a stranger to the misery of a disconsolate hearth and its fatherless children; and you, Sirs, and the general press of this country, might happily have at longer intervals to comment on such sad stories as "the loss of life by the wreck of the Alma," for the public warning and the public good.

Sept. 6, 1859. CHARLES CLIFFORD.

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THE ARMSTRONG GUN.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—While the question of rifled cannon is still being mooted, and our ships of war are likely to be fitted with the Armstrong gun, the idea naturally presents itself as to the comparative merits and demerits of this form of arm when applied to naval warfare. Now, while the advantages of long range and extreme precision are indispensable, the lasting qualities of the material from which the gun is made is no less a matter for serious consideration, and I would ask, How far has it yet been proved that a gun with a barrel of steel, and finely grooved, will resist the erosive action of sea-air and moisture? We all know how soon exposure to sea-air rusts the barrel of a common fowling-piece; and if rust acts rapidly on iron, we know it is still more destructive to steel, and it is a question whether a finely-grooved steel barrel would not soon become so pitted with rust, as to injure the precision of the arm, if not to prevent it from being fired at all. Do there not, I would ask, exist some alloys which, while they would present sufficient hardness to form the core of a rifled gun, would be unaffected by rust? I will mention a fact or two which imply the possibility of such being the case. Every one who has used a soldering iron is aware how, after a time, the copper point which is continually in contact with the solder becomes so hard that the best file will hardly touch it. Another and equally hard alloy may be made from zinc and copper mixed in certain proportions, and another exists into which enters the metal aluminium; and no doubt, with a few experiments, an alloy might be found which would answer the purpose.

Now, if such an alloy could be successfully applied, how great would be the advantage which would accrue, both in respect of cleanliness and in the durability of the arm, while from its easy fusibility it might be run into the wrought-iron case, which would give it strength and solidity.

Hoping that this idea may prove useful and interesting to some of your readers,

I have the honour to remain, Sir,
Your obedient servant,
F. MAXWELL LYTE, F.C.S.

Bagnères de Bigorre, Hautes Pyrénées, Sept. 6, 1859.

CONVERTING CAST-IRON GUNS INTO BREECH-LOADERS.

The following cutting from the *Times* may be taken for what it is worth:—"The difficulty hitherto experienced in converting the ordinary cast-iron guns into breech-loaders has at length been surmounted by Mr. Warny, the inventor of the new breech-loading percussion cannon, which during some recent trials at Chatham discharged 20 shots per minute, who has just succeeded in attaching a wrought-iron breech to a cast-iron gun, the first attempt of the kind which has, as yet, proved successful. The gun experimented upon consisted of the ordinary cast-iron barrel, weighing about 40lb., which having been rifled, Mr. Warny attached his breech-loading invention to it; this gun being also fired by percussion, as is the case with Mr. Warny's ordinary [breech-loading cannon. The breech is provided with a lever fixed at the end, which by one movement lubricates the chamber, primes the nipple, and closes the breech. By an exceedingly simple contrivance the breech can be almost instantaneously detached from the other portion of the gun, so that in the case of a sudden surprise by an enemy, these guns can have their breeches removed and be rendered entirely unserviceable. During the trials made at Chatham yesterday to test the newly-finished cannon it was ascertained that with a small charge of gunpowder the shot could be thrown 4,000 yards, or upwards of two miles, while by slightly increasing the charge a range of 5,000 yards was obtained, the gun throwing a shower of balls at the rate of 10 per minute, a rapidity of firing which the inventor is able to maintain as long as the ammunition lasts, the current of air admitted each time the breech is opened preventing the gun becoming heated and expanding. Mr. Warny has expressed his readiness to take any ordinary metal or cast-iron gun now in use, and to convert it into a breech-loader which shall be capable of discharging from 10 to 20 shots per minute a distance of at least three miles, the barrel being previously rifled."

Our Weekly Gossip.

WE have to ask the indulgence of our readers for several verbal errors which appeared in our last number, and which they have doubtless corrected for themselves—such, for example, as "great deck" for "giant deck" in the article sent from the Great Eastern, and "Plate 7" for "the engraving" on page 169. In the sentence which precedes the table giving the theoretical speeds of the Great Eastern's paddle and screw, on p. 165, an ambiguous statement also occurs, probably through the hurry in which the letter was despatched. The word "practically" should be "proportionally;" the meaning being that the relations between the revolutions of the paddles and the screw indicated by the table held when the ship was moving freely under her steam. Thus, on looking at the table, it will be seen that eight revolutions of the paddle indicates just over 13 knots of speed, which again correspond to 30 revolutions of the screw; then, it was found in practice that both engines worked well together while the one was making eight, and the other 30 (or nearly 30) revolutions. This is all that was meant. To get the speed of the ship from the table the slip must, of course, be deducted.

Numerous letters written in illustration of the alleged want of proper management in the New Works Department of the Admiralty have reached us. For the most part they involve matters of detail into which we cannot conveniently enter. We print the following as a specimen. It is written by "A Mechanic" from Pembroke Dockyard. He says:—"Gentlemen,—As another proof of the inefficiency of the New Works Department of the Admiralty alluded to in your number for August, I would refer to the new steam saw-mill building at Pembroke recently completed. The upper room is the joiners' shop, and has a glass roof. The place became so unbearably hot during the summer, and there being no means of ventilation provided, large holes were obliged to be *torn in the new end walls* to admit a current of air. The merest tyro would not have left such a thing unprovided for in the construction. The Chairman of the Dockyard Committee should be asked how much it cost for spoiled paper and clerk's time employed in *re*-rewriting letters during his superintendence of Pembroke yard. It was not a trifling item."

We have been favoured with a sight of one of the medals now in process of striking at the Mint, and intended as rewards for the valour displayed by our forces in suppressing the Sepoy insurrection in India. It is a fine work of art. The size of the new Indian medal is precisely that of the well-known Crimean decoration, and, in fact, the obverse—the head of Her Majesty, with the legend *Victoria Regina*—seems to be the product of the identical die used for those too lavishly dispensed discs of silver. The reverse, however, presents a totally different device. The British lion, or *a* lion, is shown standing in all his natural dignity beside an erect figure of Britannia, who, with an oval quartered shield on her left arm, and a reserve of wreaths in her left hand, is extending her right hand as if in the act of bestowing upon a brave, but, so far as the medal goes, invisible warrior, one of the leafy chaplets. The word *India* surmounts the head of Britannia, who it is really refreshing to see represented on her legs after so long a sitting on our expiring coinage of copper, whilst the dates 1857-1858 placed below the frieze declare the period when the immortal deeds of arms for which the medals are to be awarded were performed. The material of which the medals are composed is fine silver, the weight of each precisely one ounce, and the number to be produced, as we are informed, something like 100,000. May those for whom they are intended long survive to wear them, and if need be, go forth to earn others in the Celestial Empire, where treachery, great as that of Hindostan, seems to exist, and where British prowess *must* again be displayed. Mr. L. C. Wyon designed—as his name under the frieze denotes—the reverse of the Indian medal; whilst the late W. Wyon was the artist for the obverse.

A model showing how the ground will be laid out in terraces for the garden of the Horticultural Society has just been placed in the South Kensington Museum, at the North-end, near the entrance to the ornamental art-rooms. Between the Kensington-road and Cromwell-road the ground falls about 40 feet, and using this fact in aid of a general effect, the ground has been divided into three principal levels. The entrances to the gardens will be on the lower level, in Exhibition and Prince Albert's-roads, and the central pathway upwards of 75 feet wide, ascending through terraces to the third great level, will lead to the winter garden. The whole garden will be surrounded by Italian arcades, each of the three levels having arcades of a different character. The upper or north arcade, where the boundary is semi-circular in form, will be a modification of the arcades of the Villa Albani at Rome. The central arcade will be almost wholly of Milanese brickwork, interspersed with terra cotta, majolica, &c., whilst the design for the south arcade has been adapted from the beautiful cloisters of St. John Lateran at Rome. None of these arcades will be less than 20 feet wide and 25 feet high, and they will give a promenade, sheltered from all weathers, more than three-quarters of a mile in length. The arcades and earthworks will be executed by the Commissioners for the Exhibition of 1851, at a cost of £50,000, whilst the laying-out of the gardens and construction of the conservatory or winter garden, will be executed by the Horticultural Society, and will cost about the same sum, the greater part of which has been already raised.

Mr. Lough has completed, says the *Leeds Intelligencer*, a model of the statue of George Stephenson, with its pedestal, the monument intended for Newcastle-on-Tyne. The height of the figure is 7 feet 8 inches; but the actual casting model will measure 10 feet high. The figure is upright, and attired in modern costume, with a plaid crossing the chest from the left shoulder; the right hand, holding a pair of callipers, rests on the breast, and the left on a locomotive engine of very early form. The pedestal intended for the support of this statue presents at its four angles types of the labour necessary to engineering works; these are, accordingly, a navvy, a blacksmith, a pitman, and an engineer.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 317, 343.
BOILERS AND THEIR FURNACES, &c., 369.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 317, 324, 351, 356, 373, 376, 379, 383.
SHIPS AND BOATS, including their fittings, 328, 329, 341, 377, 378, 392, 399.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 327, 353, 391, 389.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 320, 330, 333, 355, 370, 371, 382, 400.
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BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c. *None.*
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WARFARE, 336, 367, 372, 402.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 315, 316, 319, 322, 323, 325, 326, 331, 333, 348, 352, 354, 357, 358, 359, 361, 362, 374, 375, 384, 387, 388, 391, 394, 396, 401.

315. H. GREAVES. "Improvements in the preparation of iron bars, of the various forms or sections used in the construction of sheet-iron structures, and in machinery employed for the same." Dated Feb. 4, 1859.

This consists in punching the rivet-holes required in the various parts of iron structures while the iron is hot, and by means of suitable machinery. *Patent abandoned.*

316. W. THOMPSON. "An improved printing telegraph." Dated Feb. 4, 1859.

The improved manipulator consists of a finger-board containing a certain number of keys or touches which are attached to a corresponding number of straight levers; these are connected with an equal number of small rectangular metallic levers which are placed in a circle round the arbor of the escapement wheel of a common clock train or movement, and directly under a horizontal wheel containing thirty little points which the levers are calculated to push out beyond the circumference of the wheel whenever the keys or touches are acted upon by the operator. The same touch that pushes out the pin corresponding with the letter on the type wheel of the receptor pushes in the pin that is against a fixed post, and stops the instrument each time that the last pin pushed out comes against it, and thus prevents any further action until another letter is made. This double motion of pushing in the preceding pin at the same time you push out another is obtained by an apparatus placed under each of the straight levers. The escapement and pin wheels are on the same arbor, and are put in motion by a common clock train. The receptor is put in motion by two clock trains. *Patent abandoned.*

317. A. ALLAN. "Improvements in locomotive steam engines, in part applicable for retarding and stopping railway trains." Dated Feb. 4, 1859.

This invention is not described apart from the drawings. *Patent completed.*

318. J. W. HART. "Raising water or other liquids and compressing and forcing fluids, atmospheric air, or other aeriform bodies." Dated Feb. 4, 1859.

Provisional protection was not granted for this invention.

319. S. L. TROTMAN. "Improvements for the more effectually securing or fastening envelopes or other like receptacles, and the more securely affixing postage-stamps or other adhesive labels." Dated Feb. 4, 1859.

This consists, 1, in forming envelopes with a tongue gummed on both sides, and a pocket in the back of the envelope into which the tongue is inserted when the envelope is closed. 2, in protecting the gum from the external action of steam, &c., by coating so much of the paper as may be required to cover the gum with a waterproof material, such as varnish, drying oil, or oil paint. *Patent abandoned.*

320. R. A. BROOMAN. "An improvement in cooling worts and beer." (A communication.) Dated Feb. 4, 1859.

This consists in causing a current of cold water to circulate through passages suitably arranged beneath the vessel containing the worts or beer, and thereby gradually and quickly reducing the temperature of the same. *Patent completed.*

321. R. A. BROOMAN. "Improvements in shirts." (A communication.) Dated Feb. 4, 1859.

This consists in so arranging shirts that buttons on the neck band and front are dispensed with; in giving such an amount of stiffness or support to the front that but little, if any, starch is required; and in making the sleeve without any side opening at the wrist, but simply an aperture for the hand to pass through. *Patent abandoned.*

322. G. H. BAYLIS and F. ROBINSON. "An improved indicator for registering the withdrawal of liquids from vessels." Dated Feb. 4, 1859.

This indicator is composed of a circular box, having a dial on its front surface marked with gills, pints, quarts, &c., up to gallons. On the lower part of this dial a second smaller dial is placed marked with gallons only. A spindle is passed through the centre of the box, having a hand on its outer end, and the other end passes through a barrel over which is wound a cord, one end whereof is secured to the barrel, the other end having a float attached thereto, which enters the top of the cask, and floats upon the surface of the liquid, so that as the liquid falls into the vessel the quantity withdrawn is indicated upon the dial until the vessel becomes empty. The two dials are worked together within the box by toothed wheels, as in clock-work. *Patent completed.*

323. F. H. MABERLY. "Improvements in obtaining spring power, and in its application to various purposes." Dated Feb. 4, 1859.

The patentee prefers to use box springs with fusees. One or more of each is to be operated upon by levers and ratchets. The ratchet apparatus is affixed by squares to the spindles of the fusees, so as to be moveable at pleasure, and the ratchets are worked by levers operated upon by racks and pinions. The racks are supported or balanced by weights, and these racks worked up and down by double cogged or other pinions, the racks carrying the levers of the ratchets up and down. These double cogged or other pinions are themselves revolved by ratchets and levers, such as aforesaid, operated upon by hand or other power. *Patent completed.*

324. L. BONNEAU. "Improvements in apparatus for registering the time carriages are employed in conveying persons from place to place, and also in moving from place to place when unoccupied." Dated Feb. 4, 1859.

Here two markers, or pencils, and a ring of paper are arranged in connection with the seat of a cab or other vehicle, so that when the vehicle is in motion one of these pencils oscillates and makes a zig-zag mark, and when the seat is depressed by the weight of a passenger the second pencil is caused to mark. *Patent abandoned.*

325. J. M. E. MASSON. "Improvements in apparatus to facilitate working under water." Dated Feb. 4, 1859.

This invention is not described apart from the drawings. *Patent completed.*

326. P. ADIE. "Improvements in apparatus for taking levels and measuring angles." Dated Feb. 4, 1859.

This relates to arranging the instrument known as the ordinary levelling telescope with parts in connection therewith, so that the same may be used as a theodolite. We cannot give space to the details of this invention. *Patent completed.*

327. W. R. J. PACKER. "Improvements in the plough or plough-share, for the purpose of more effectually pulverizing, breaking up, or cutting into small particles the earth or sod separated from the ground by the plough-share." Dated Feb. 4, 1859.

This consists principally of a cylinder placed to the plough-share which moves a wheel, and by means of this wheel a pinion, with or without a square or collette attached, studded with rakes or spikes, revolves, and by such revolution the earth is crushed. *Patent abandoned.*

328. J. HONEYMAN. "Improvements in the construction of ships, vessels, and boats, and in propellers for propelling the same." Dated Feb. 4, 1859.

Here the lower part of the hull of a ship is built of a cylindrical figure, the width of which corresponds to the width of beam at the upper part of the hull. The enlarged portion extends from the bow nearly to the stern, where it is hollowed in so as to form a recess at the parts adjacent to the stern post. The cylindrical portion of the hull projects well out at the stern, where it is enclosed by metal plates or timber, so as to form a flat vertical surface. At this part a screw propeller is fitted, the driving shaft of which is carried through the end disc of the cylindrical part. The propeller consists of a conically-shaped drum, having vanes or blades extending backwards in a curved direction from the apex of the cone to the base. *Patent completed.*

329. A. BARCLAY. "Improvements in electric, magnetic, or electro-magnetic telegraph ropes or conductors, and in machinery or apparatus to be used on board ship for laying or paying out the same." Dated Feb. 4, 1859.

Here the component wires or strands of the cable are covered individually with hemp, &c., and each strand is passed through melted tar, pitch, &c., and afterwards through sand. The strands are passed through squeezing rollers. The whole cable is finally treated in the same way. In paying out cables, after the cable leaves the ship's hold, it passes over a species of elasticated guide block tackle, that is, over a series of upper and lower pulleys, the spindles or centres of which are suspended from the ship by caoutchouc, &c. There are modifications included. *Patent abandoned.*

330. W. CLARK. "Improvements in the means or apparatus for preserving grain, flour, eggs, and other vegetable and animal substances." (A communication.) Dated Feb. 4, 1859.

This consists in enclosing the substances to be preserved in a cylinder formed of wooden staves united by iron hoops. This cylinder is enclosed in a tinned iron case, perfectly soldered, to exclude air. This case has at top and bottom a hoop of brass rivetted and soldered to the cylinder. This brass hoop has a brim or flange, and it is by this flange that the lid is bolted thereto. To render the joint air tight, a thickness of india-rubber is placed between the lid and cylinder. On the metallic casing is rivetted and soldered a plate furnished with a stop cock to place the cylinder in communication with an air pump by which a vacuum is produced. *Patent completed.*

331. F. H. MABERLY. "Improvements in apparatus for corking, for drawing corks, in taps, in the necks of bottles, in the bung-holes of barrels, and in similar articles." Dated Feb. 5, 1859.

The inventor proposes to compress the corks by a screw or screws conjointly with other power, so as to render them fit for putting into the bottle without any other force than that of the finger and thumb. The cork drawer is to be of the needle kind, plain, or screwed, or wormed, easily passing through the cork, and then throwing out spring barbs, so that the cork drawer cannot be withdrawn without bringing out the cork. *Patent abandoned.*

332. N. GREENHALGH, W. SHAW, and J. MALLISON, jun. "Certain improvements in the treatment and preparation of yarns or threads previously to dyeing." Dated Feb. 5, 1859.

Here the "cops" of yarn to be treated are placed in a suitable chamber in connection with an apparatus for exhausting the air therefrom; and when the yarn is thus in vacuo, a solution of shumac or catechu is to be introduced and the yarn thoroughly saturated. It is then submitted to the action of "hydro-extractors" to dry out the superfluous moisture, and afterwards placed in vacuo again, and (if to be dyed black) saturated with a solution of iron. It is then dried, and is in a condition to be woven into cloth with a woollen or worsted substance or alpaca, hair, &c. *Patent completed.*

333. R. TINKER. "Improvements in churns." Dated Feb. 5, 1859.

This relates, 1, to rotatory churns, and consists in arrangements whereby the barrel can be set steady or fixed in several different positions as regards its rotation. It relates, 2, to the bungs of churns, and consists in making them of a piece of india-rubber combined with wood. It relates, 3, to an improved air discharge valve, whereby it can be readily taken out and cleaned. The metal portions of the bungs and valves are electro-plated. *Patent completed.*

334. H. ANDERSON. "An improved construction of apparatus for winding window blinds, sun shades, and similar articles on their rollers." Dated Feb. 5, 1859.

This consists of a framing through which is passed two journals, the end of the one being fastened to the blind roller. To this journal is affixed by a stud a steel coiled spring. The other end is fastened to the framing. On the same journal is also a toothed wheel gearing with a small pinion on the other journal; on this latter journal, alongside the pinion, is a ratchet wheel, and on it the end of the lever, to which is attached the cord, is made to rest by a knee-shaped spring. *Patent abandoned.*

335. T. SYKES and B. C. SYKES. "Improvements in obtaining or separating oily, fatty, greasy, tarry, waxy, and resinous substances, from oleaginous seeds, nuts and fruits, wool, silk, hair, cotton, flax, line, hemp, furs, skin, leather, bones, fish, and other animal matters and refuse, woollen and cotton waste and refuse, also textile fabrics and refuse grease produced in various branches of industry, indigo, lac, lac dye, and other dyes." Dated Feb. 5, 1859.

This relates, 1, to the use of bisulphide of carbon as a solvent; and, 2, to the use of hydrostatic pressure, with water or other fluid, to facilitate the percolation of the solution of the oily, waxy, or resinous substances in the bisulphide of carbon or naphtha through the bodies treated, and ultimately to displace it. *Patent completed.*

336. T. R. AYERST. "Improvements in breech-loading guns and other fire-arms." (A communication.) Dated Feb. 5, 1859.

This consists in forming a clear opening through the breech, and applying a closing piece consisting of a cross piece mounted on a joint or hinge pin on one side of the bore. This hinge piece is received in a recess when in position, which with suitable shoulders abuts and holds it close against the back end of the bore. The hinged piece is of considerable thickness, and has a screw bolt or plug piece screwed through it in the direction of the bore, the nose of which enters therein, effectually closing the barrel at the breech, and also fixing the hinged piece securely in its place. The back end of the bore is enlarged, forming a recess into which the nose of the screw enters, the nose or end being somewhat larger than the bore, and which nose abuts against the shoulder so formed. The screw stem projects in the rear of the hinge piece, and has a short hand lever by which

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it is turned. When it is turned about a quarter of a revolution, and so as to withdraw the nose of the screw from the bore, the screw meets with a stop in its rotatory motion on its own axis, so that the further movement of the hand lever moves the cross piece on its hinge or joint pin, thus throwing it over out of the line of the barrel, and thereby disclosing the bore, and affording sufficient freedom for loading from behind. The reverse movement of the cross piece and the hand lever effectually closes the breech, and makes the gun ready for firing. *Patent completed.*

337. M. Booth and J. Farmer. "Improvements in sizing or stiffening woven fabrics." Dated Feb. 5, 1859.

This consists in so passing the goods through the size that one side thereof only becomes coated, and in so removing the superabundant quantity that it shall not fall again on to them. *Patent abandoned.*

338. G. F. Chantrell. "Improvements in the treatment of charcoal after its manufacture or revivification." Dated Feb. 7, 1859.

The patentee proposes to expose the charcoal to the action of the atmosphere by a system of endless travelling bands or aprons arranged horizontally one above another, and stretched upon transverse rollers at each end, through one or both of which motion is communicated to the endless bands. The charcoal is fed to the upper apron of the series from a hopper, having arrangements to regulate the supply of charcoal delivered to the endless bands. *Patent completed.*

339. J. Holroyd. "An improvement in apparatus used in finishing woollen and other cloths." Dated Feb. 7, 1859.

This applies principally to a machine for turning back the nap, and consists in interposing a sheet of brass or other tinsel between the cloth and the card cylinder, so that only a part of the surface of the cloth is exposed to the action of the cards, thereby producing a pattern on the cloth. *Patent abandoned.*

340. A. Lyons. "A pocket protector." Dated Feb. 7, 1859.

This consists in applying a strip of steel to the mouth of the pocket, so as to be hinged together at one end, and admit of being opened and closed at the other by a hasp, &c. *Patent abandoned.*

341. W. H. Crispin. "An improved atmospheric and hydraulic engine for sailing and steam vessels." Dated Feb. 7, 1859.

The elemental power is here obtained by the oscillation of a pendulum, the vibration whereof is caused by the motion of the ship, suitable arrangements of wheel-work being actuated by the pendulum when in oscillation. The power thus obtained may be applied either in a direct manner, or may be used for the condensation or exhaustion of atmospheric air, or for the working of hydraulic arrangements. *Patent abandoned.*

342. M. Curtis and J. Miller. "Improvements in certain mules for spinning cotton and other fibrous substances." Dated Feb. 7, 1859.

The patentee claims the application of a shaft and gearing to communicate motion from the tin roller in one carriage to the tin roller in another carriage, where tin rollers are used, and the like means where tin drums are employed to communicate motion from the shaft which drives the drums in the one carriage to the corresponding shaft in the other. *Patent completed.*

343. J. Lee. "Improvements in the manufacture of cranks for steam engines, and other purposes." Dated Feb. 7, 1859.

The bar to be formed into a crank is heated in a furnace, and somewhat upset or thickened at the place where the crank is to be formed. It is then placed in a machine furnished with dies, which are forced towards each other so as to bend the bar to the required form. The upper die is formed with a projection at its centre corresponding to the form of the crank, and has at its two ends friction pulleys to allow the bar to run easily over the surface of the die to furnish the length of bar requisite for the bend. The projection of this upper die when bending a bar to form a crank passes down between two lower dies, which are each furnished with a friction pulley at the upper corner or angle against which the bar is forced by the projection of the upper die, and these friction pulleys are for allowing the bar to run freely over the angles of the dies to supply the length taken down by the projection of the upper die. *Patent completed.*

344. T. Sims. "Improvements in the application of photography to engraving and printing." Dated Feb. 7, 1859.

The inventor employs a film of collodion, either alone or covered with albumen or gelatine, on a surface of glass or talc, and he produces the photographic picture upon it either in the wet or dry state in the ordinary manner. He then submits the film to the action of bi-chloride of mercury and ammonio-chloride of gold, to cause the lines of the picture to swell or rise, and become absorbent. He then covers the film with a thin coat of varnish, which speedily dries on the porous raised lines or parts, leaving the other parts wet. He then dusts over the picture a quantity of powdered resin or gum, &c., which adheres to the wet parts. The picture is now in a fit state for transferring to paper, stone, copper, steel, or zinc. *Patent abandoned.*

345. E. T. Hughes. "Improvements in ovens." (A communication.) Dated Feb. 7, 1859.

This consists in arranging two or more fires under the oven, the heat and smoke of the lower fire passing through the one above by means of the grate bars, which bars may be made of fire-clay or metal tubing; if of the latter they must be filled with water. There are flues with valves suitably arranged for regulating the heat. *Patent abandoned.*

346. J. Smith. "Improvements in machinery, or apparatus for preparing and combing wool and other fibrous substances." Dated Feb. 7, 1859.

This consists in the use of a circular currying comb, suitably arranged in connection with other parts; also in the use of a series of rectangular double comb surfaces, arranged and actuated in a manner which we cannot on account of space describe in detail. *Patent completed.*

347. J. Wilson. "Improvements in ventilating mines, and in combining apparatus used for such purpose." Dated Feb. 7, 1859.

This consists in the construction at the mouth of the downcast shaft of the mine of a gasholder or receiver of a capacity and strength proportionate to the quantity and pressure of the atmospheric air required for the supply of the workings of the mine, and for maintaining the purity of its atmosphere. To this receiver is attached a force pump or pumps, and by means of pipes leading to the different parts of the mine, the object of the invention is effected. *Patent abandoned.*

348. T. Moss. "Improvements in the manufacture of paper and printing ink, suitable for bank notes, bills of exchange, and other documents requiring like security against being copied." Dated Feb. 8, 1859.

In manufacturing paper the patentee combines with the pulp the colouring matter he may desire; and he uses in the preparation of his colours burnt china or other clay, oxide of chromurin, or sulphur. In the manufacture of printing inks he employs burnt china or other clay and sulphur, ground up with suitable drying oils or varnishes. *Patent completed.*

349. E. T. Hughes. "Improvements in machinery or apparatus for sorting and numbering the threads or filaments of silk or other fibrous materials." (A communication.) Dated Feb. 8, 1859.

Here certain defined lengths of the thread or filament are wound on bobbins, and then weighted to determine the numbers. The operation is divided into the process of dividing, cleansing, and doubling, for which a bobbin and a regulating counter may be employed, these two contrivances being subordinate to an arrangement by which the bobbin stops the moment that one or more threads break. *Patent abandoned.*

350. J. Hosking. "Improvements in the manufacture of lamps." Dated Feb. 8, 1859.

This consists, 1, in causing a greater quantity of air to be brought into direct contact with the wick or burner than heretofore. 2. In bringing two currents of air into contact with the wick, and also in certain arrangements in connection with the chimney. *Patent completed.*

351. G. Thomas. "A double bottomed horse-shoe." Dated Feb. 8, 1859.

This consists in shoeing horses with two shoes on each foot. One shoe, or the shoe proper, is to be fastened to the hoof by nails. This shoe in the centre part is dovetailed so as to admit of the second shoe being placed thereon. In winter the under shoe may be taken off and replaced by a "roughed" one with the utmost ease and rapidity. *Patent abandoned.*

352. E. Bagnicke. "An improved syringing apparatus for curing leucorrhea, and similar sexual diseases." Dated Feb. 8, 1859.

This consists of an apparatus whereby the curing of sexual diseases is effected by injection in combination with electricity, which latter acts in connection with the dormant electricity of the human body, so as to produce the desired electrical effect simultaneously with the injection of the fluid. *Patent completed.*

353. W. Waller. "Improvements in agricultural or farm implements or apparatus." (Partly a communication.) Dated Feb. 8, 1859.

This comprises various improvements in ploughs, harrows, reaping machines, horse or hand rakes, and presses for cheese curds, fruit, &c., the details of which are too voluminous for our pages. *Patent abandoned.*

354. R. R. Rowntree. "A portable tea-testing apparatus." Dated Feb. 8, 1859.

This consists in enclosing within an outer case a vessel for containing water for boiling, a gas-burner, and a series of cups and pots fitting one within the other, as also a spoon, together with a length of elastic tubing coiled and contained within a case for communicating from an ordinary gas-burner to the apparatus, and containing the several parts in position when stowed away in the outer case. *Patent abandoned.*

355. J. Aspinall. "An improvement in the refining of sugar." Dated Feb. 8, 1859.

The patentee claims the method of melting sugar in the refining thereof in such manner that the melting shall take place at or near the surface of the water used to melt the same, and before the sugar comes in contact with the steam, steam-pipes, heated bottom or sides of the pan, or other medium for heating the contents of the pan. Also the employment in pans for carrying on the "surface melting," of two or more perforated false bottoms or plates. *Patent completed.*

356. J. B. Redman. An improvement in the construction of carriage ways." Dated Feb. 8, 1859.

The patentee claims constructing carriage ways with boxes, troughs, and cases of iron adapted and combined, and having surfaces upon which wheels are to travel, with a diamond or other like raised pattern. *Patent completed.*

357. A. Clark. "Improvements in revolving shutters and blinds, and in apparatus connected therewith." Dated Feb. 8, 1859.

This consists, 1, in making rolling shutters or blinds of sheets of corrugated metal. 2. In making shutters or blinds of fibrous material, combined with strips of steel, or of wire interlaced with the fibrous material. 3. In the application of an endless band of steel to communicate motion to the roller for winding up the shutters and blinds. 4. In the use of strips of tempered steel to connect revolving shutters or blinds to the rollers on which they are coiled. 5. In making revolving shutters and blinds of a series of laths or strips having a semi-circular curve along each edge, the convex of which curved edges are placed in contact to form the exterior of the shutter or blind. 6. In making snail or volute grooves, in continuation of the side grooves, whereby shutters and blinds may be coiled and uncoiled simply by pushing them up into, or pulling them down out of, such volute grooves. *Patent completed.*

358. W. Clark. "Improved protectors for tobacco plants." (A communication.) Dated Feb. 8, 1859.

The inventor encloses the stalk in a small tube or pipe of baked clay. *Patent abandoned.*

359. T. S. Cressey. "Improvements in machinery used in the manufacture of casks." Dated Feb. 8, 1859.

This consists in a peculiar combination of apparatus applied to a lathe to facilitate the cutting of the heads of casks, such apparatus being put in motion by the rotation of the wood which is to form the head of a cask. *Patent completed.*

360. J. Juckes. "Improvements in stoves or fireplaces." Dated Feb. 8, 1859.

Here an inclined bottom is fitted to each stove, under which inclined bottom is a drawer containing the fresh fuel, and the pushing in of this drawer causes the fresh fuel to rise up into the fire. *Patent abandoned.*

361. E. Wilkins. "Improvements in flower vases." Dated Feb. 9, 1859.

The arrangements here adopted are not described apart from the drawings. *Patent completed.*

362. J. S. Joseph. "Improvements in coke ovens, and in cooling and extinguishing coke." Dated Feb. 9, 1859.

The patentee constructs an oven with an arched roof having an aperture or apertures. Over this roof he places another roof, from which flues are carried down the sides and under the bottom of the oven, and away to a chimney, and a regulated quantity of air is admitted into the oven and flues to effect the combustion of the gases. The coke when finished is pushed out by a plate and a rack and pinion. The floor of the oven is constructed with a shallow recess into which water is introduced, and the steam arising from this water cools the coke and carries off the sulphur. *Patent completed.*

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363. W. ARCHER. "Certain improvements in Jacquard machines." Dated Feb. 9, 1859.

This consists, 1, in effecting the ascent of one "griff" and the descent of another simultaneously by a toothed pinion situated between the two griffs, and taking into a rack upon each griff, the pinion being caused to partake of the required reciprocating semi-circular motion by the ordinary means, so as to lift one griff and lower the other by the same semi-circular movement of the pinion. 2. In so connecting a helical or other spring with the "batten," that upon any wrong working of the machine the said spring shall yield to the extra pressure and prevent breakage of the machine. 3. In mounting the blades in the griffs upon pivots or centres at each end, upon which they may vibrate, so as to allow them to yield to the wire hooks. *Patent abandoned.*

364. H. JEFFERIES. "An improvement in castors." Dated Feb. 9, 1859.

Within a socket or collar of metal, a cup of glass, earthenware, or steel is fitted in an inverted position; into this cup a sphere of wood is placed, and is secured in its position by a ring screwed or otherwise fixed over it, but so as to allow of the sphere turning freely within its cup. When the castor is in use the sphere rests on the surface, supporting the piece of furniture of which the castor forms part, and when the piece of furniture is moved the sphere turns and allows it to run freely. *Patent abandoned.*

365. J. CROSSLEY. "Improvements in the means employed when cleaning printed yarns." Dated Feb. 9, 1859.

According to a patent granted to the inventor August 21, 1856, zinc or metal plates placed between the supports to the yarns are employed for catching the droppings of the colours of one set of yarns from falling into and mixing with colours of the yarns below. Now, the first part of the present invention is to obviate the condensation of steam underneath the plates. For this purpose these plates are so formed as to admit of the introduction into the inside thereof of steam or other heating media, which serves to keep the plates constantly hot, and so prevent condensed steam gathering underneath the plates, and thereby dropping the yarns below. The invention consists, secondly, when steaming printed yarn, in the use of troughs placed underneath the cradles, such troughs containing water heated to a great degree, and the steam arising from the hot water passes at once through the yarn placed on trays immediately above it, thus fixing the colours of the yarn, and the steam then passes away out at the top of the chamber, and carries away with it the impure gases arising from the colouring matter. The outer framework of the cradle frames is made of cast-iron. *Patent completed.*

366. J. TAYLOR and C. WILD. "Improvements in self-acting mules for spinning and doubling." Dated Feb. 9, 1859.

Here the spindles, carriages, and fallers, and the drawing rollers, are of ordinary arrangement. The spindles are driven from a "rim pulley" in the first motion shaft; the carriage is drawn out and taken in by bands, drums, and scroll drums, similar to those used in ordinary mules. On the completion of each stretch, the belt is traversed from the fast to the loose driving pulley; the taking-off motion is put out of gear, and the backing-off motion is put into gear by the direct action of the carriage on suitable levers. We cannot give space to the details of the invention. *Patent abandoned.*

367. J. H. JOHNSON. "Improvements in fire-arms." (A communication.) Dated Feb. 9, 1859.

This relates to self-primers for fire-arms, and appertains more particularly to that class of self-primers where the magazine is contained in the hammer of the lock of the fire-arm. It consists in so arranging the parts that the person using the arm can always see at a glance whether his magazine contains primers or not, without the trouble of taking the whole to pieces for that purpose. *Patent completed.*

368. G. BOWER. "Improvements in apparatus for the manufacture of illuminating gas." Dated Feb. 9, 1859.

The specification of this invention is too elaborate for us to quote it at sufficient length for an intelligible abstract. *Patent completed.*

369. J. E. MCCONNELL. "Improvements in steam boilers, and in the generation and treatment of steam." Dated Feb. 9, 1859.

This consists, 1, in so arranging and fitting up the tubes of steam boilers that the heated current of gaseous matter passing through them may be effectually commingled and applied to the tube surface. 2. In a mode of superheating steam. *Patent completed.*

370. W. E. NEWTON. "An improved mode of bleaching and purifying or refining sugar and vegetable juices or extracts." (A communication.) Dated Feb. 9, 1859.

This consists in the use of some highly oxidised substances, such as the peroxides of manganese and iron, either artificial or natural, or the carbonates of these bases. *Patent completed.*

371. E. HERRING. "Improvements in the mashing and fermenting of grain for the production of alcohol." Dated Feb. 9, 1859.

This consists in adding to the mashes of unmalted or malted grain a carbonated or a caustic alkali (to be neutralised or not at pleasure), firstly, for the solution of the gluten, and, secondly, for the entire preservation of the works from the formation of acetic acid, and for the neutralisation of the existing lactic acid, which latter may be liberated at pleasure by the addition of an acid (muriatic being preferable), forming the neutral muriate of soda or common salt in small quantity, restoring the lactic acid in its original quantity, and generating carbonic acid, and consequently virgin fermentation. *Patent completed.*

372. W. E. NEWTON. "Certain improvements in breech-loading fire-arms, and in cartridges to be used in such fire-arms." (A communication.) Dated Feb. 9, 1859.

This relates to the construction of the breech and chamber of fire-arms, and to the mode of opening the chamber to receive a cartridge, by which, with the use of a cartridge case made of some impermeable and elastic substance, such case is made to serve as a packing to make the breech-joint perfectly tight when the explosion of the charge takes place. It also relates to the means of locking the barrel and breech together to keep the breech-point close, and to the means of unlocking these parts. *Patent completed.*

373. H. P. BURT. "Improvements in railway carriages and waggons." Dated Feb. 10, 1859.

This consists in applying to the axles or wheels of railway carriages a wheel and pinion, or a wheel and screw, or a chain wheel and pinion, or a friction wheel and pinion, or other contrivance for multiplying power. There are handles or hand-wheels or ratchet handles to the same, by turning or moving which a carriage may be stopped or started with facility *Patent completed.*

374. J. YOUNG. "An improvment or improvements in the construction of knobs and the roses used for connecting knobs with doors, and with the cases of locks and latches, and other like fastenings." Dated Feb. 10, 1859.

This invention is not described apart from the drawings. *Patent completed.*

375. J. G. TAYLOR. "Improvements in writing materials, and the manufacture thereof." Dated Feb. 10, 1859.

This comprises various improvements in inkstands, pencils, pens, penholders, and brushes for cleaning pens, the details of which are too voluminous to be quoted here. *Patent abandoned.*

376. W. A. COVERT. "An improved self-acting railway switch." (A communication.) Dated Feb. 10, 1859.

Here the engine and tender and the last carriage of each train are provided with two small rollers capable of being raised up or lowered by the driver or guard, and so connected together that the depressing of the roller on one side shall cause the raising of that on the other side. If the engineer desires the train to run off on to a siding at the right hand of the main line, or otherwise to diverge to the right before reaching the points, he depresses the right hand roller. As the engine approaches the points, this roller coming against the inclined plane, will thrust the moveable rail on that side outwards, and by means of the cross bar draw the switches into the required position. The projection on the cross bar gears into a peculiar form of locking cam, consisting of a circular plate provided with a notch and two projecting fingers or catches, and capable of turning on a pin on the tie connecting the switches, which prevents the switches from being moved by any other agency than the action of the moveable rails. By the use of this switch the necessity for employing pointsmen is entirely dispensed with. *Patent completed.*

377. R. J. ELLIS. "Improvements in apparatus for lifting sunken vessels and other submerged bodies." Dated Feb. 10, 1859.

This consists of one or more cylindrical or other shaped vessels of large capacity. Each vessel has two or more floating ball valves which open inwardly, and a large spring valve or valves which open outwardly when the internal pressure is greater than the external pressure. These pontoons are fitted internally with a number of hydraulic cylinders placed in a longitudinal line with the floating and spring valves. These hydraulic cylinders are connected together by pipes which form passages for water from the bottom of the interior of one cylinder to another, and are fitted with pistons and piston-rods, which work through stuffing-boxes in the bottom of the vessel. The lifting chains are attached to the outer ends of the piston-rods by which arrangement the strain will be equal on each. One or more of these pontoons are placed side by side, and attached together by strong beams, on which a deck can be laid, and a mast or masts rigged for sailing them from place to place. When these pontoons are to be brought into operation, by allowing the floating valves in the bottom to work, the water will enter the vessel, and cause it to sink to the wreck; &c., the lifting chains being made fast to the object required to be lifted, are then attached to the ends of the hydraulic piston-rods. The water is then forced from the interior of the pontoon through the openings of the floating valves by atmospheric air forced therein through a pipe from the surface by an air pump, which is worked on board an attendant vessel. *Patent completed.*

378. G. L. STOCKS. "Improvements in steering apparatuses." Dated Feb. 10, 1859.

This invention is not described apart from the drawings. *Patent completed.*

379. H. INGER. "The improvement of blinkers used by horses whilst drawing, to be called the 'Patent Safety Blinker.'" (A communication.) Dated Feb. 10, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

380. B. BURROWS. "Improvements in looms for weaving narrow fabrics." Dated Feb. 10, 1859.

This consists, 1, in so arranging the various parts of the loom employed that the same loom may be used to produce, opposite each rod or slay, or opening in the batten, either a fabric having the wefts of two shuttles, one on one side and the other on the other side, or two fabrics of lesser width, each having the weft of only one shuttle introduced therein. 2. In arranging such descriptions of looms in sections or parts, all capable of being worked together as an ordinary loom. *Patent completed.*

381. C. L. PERRY. "An agricultural implement for paring and ploughing land." Dated Feb. 10, 1859.

This consists of a framing supporting two, three, or more instruments of the kind commonly employed for paring or skim ploughing land, the said instruments being so arranged as to be capable of being raised and lowered at will. *Patent abandoned.*

382. M. BILLING and W. KLOEN. "A method of, and apparatus for, decolourising tea." Dated Feb. 11, 1859.

This consists in exposing the tea to the action of steam. *Patent abandoned.*

383. J. EVANS. "An improvement in 'Hansom' cabs." Dated Feb. 11, 1859.

Instead of connecting the scroll ends on the front part of the floor of the cab to the shafts by rigid iron stays, the patentee connects them thereto by springs of steel or other suitable metal, the tail end of the said springs being attached to scroll loops or other connections fixed upon the under side of the shafts. The back stay connecting the floor of the cab to the heel of the shaft, instead of being rigid, is furnished with a butt hinge joint at or near its centre, having only a very slight amount of movement, but still sufficient to allow of the play necessary for the full development of the invention. *Patent completed.*

384. J. PARKINSON. "A certain improvement in coffins." Dated Feb. 11, 1859.

This consists in manufacturing coffins of glass. *Patent abandoned.*

385. N. BENNETT. "Improvements in the construction of brooms or brushes for sweeping or cleansing streets, roads, and thoroughfares, also applicable to domestic purposes." Dated Feb. 11, 1859.

The inventor lengthens the heads and forms them of one half the width, so as not to increase their weight, but as the handle (if placed in the centre) would be found awkward in the hands of the operator, he proposes forming it Y shaped, either in pieces, or by splitting the handle about one third of its length, inserting each of the prongs in the broom-head about one-third distance from each end thereof. As in decreasing the width of the broom-head now in use the power of resistance would be lessened, he proposes, so as to obtain sufficient resistance, that the bone, &c., whereof the brush is composed shall be of different strengths and sizes, and that the lesser size should be placed in that part of the broom-head farthest from the operator. *Patent abandoned.*

386. H. BRUCE. "Improvements in apparatus for the manufacture of paper." Dated Feb. 11, 1859.

This relates to a mode of manufacturing paper so that the web as it leaves the paper-making or air-drying machine is coated with a mixture, in which way papers of every shade of colour may be made,

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and the web may be coated upon one or both sides. It is then dried, and subjected to the glazing process which produces an enamelled paper. *Patent completed.*

387. G. HYDE. "A pen for producing a copy or copies of a letter or other writing simultaneously with the production of the original." Dated Feb. 11, 1859.

The inventor employs a pen of extreme hardness or rigidity, so that when writing upon paper with ordinary ink, having beneath the paper carbonic or similar transferring medium, and under that medium paper intended for the copy, an exact copy of the writing will be produced. *Patent abandoned.*

388. R. COGAN. "Improved instruments for crushing and mixing solid and liquid substances." Dated Feb. 11, 1859.

This invention is not described apart from the drawings. *Patent completed.*

389. H. A. BARTLETT. "Improvements in machinery to be used with or without the plough for clearing and cleaning land from weeds." Dated Feb. 11, 1859.

This invention consists, as applied to a plough, of a framework extending lengthwise beyond the ground iron, and vertically to the shafts or handles. This framework has attached to it a driving wheel, which gives motion to a shaft or drum from which pegs or teeth project, and in their revolution take up the weeds. These teeth come in contact with another drum or roller provided with rakes, pegs, or teeth, for freeing the first of weeds. *Patent abandoned.*

390. C. JACKSON. "Improvements in the action of pianofortes." Dated Feb. 11, 1859.

In order to obtain the escapement of the fly or hopper the patentee fixes to the front of it at right angles, or nearly so, a straight projecting piece, the end of which comes underneath a stop carried by a stem fixed in the block on which the fly or hopper is mounted. This stop is adjustable by a screw, and by it the fly or hopper can be arranged to escape at the proper time from the hammer or other instrument on which it acts. Below the projection from the fly or hopper he sometimes places another adjustable stop, also mounted on the block carrying the hopper. This second stop is employed in substitution of the rail ordinarily used to prevent the flys or hoppers from falling farther from the hammers or instruments on which they act than is necessary. *Patent completed.*

391. J. GRIMES. "Improvements in beer-engines." Dated Feb. 11, 1859.

This consists in applying to beer-engines cooling cylinders, such cylinders being surrounded with ice, and through which cylinders the beer, &c., is caused to pass after it leaves the pump cylinder, and before it passes to the cock or spout by which it is drawn off. *Patent completed.*

392. H. RANSFORD. "An improvement in building ships and other vessels." Dated Feb. 11, 1859.

This consists in constructing each ship or vessel wider at the floor than at the water line, the fore and aft parts below the water-line being modified accordingly. *Patent abandoned.*

393. G. HADWEN and J. WADSWORTH. "Improvements in Jacquard apparatus applicable to power-looms." Dated Feb. 12, 1859.

This consists in employing two card cylinders, and two sets of hooks and needles, two needle boards, and two spring boxes, both sets of hooks and needles being united to one harness by double neck-bands. The patentees cause each cylinder to work half the number of cards of the pattern. *Patent completed.*

394. H. LEA. "Improvements in changing or reversing motion." Dated Feb. 12, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

395. T. WILLIS and G. CHELL. "Improvements in machinery for spinning, twisting, doubling, and winding yarns and threads." Dated Feb. 12, 1859.

This relates to a previous patent, and consists in employing revolving friction discs for imparting motion to the bobbins or spindles, which discs serve as pressers for building the yarn or thread on to the bobbins or spindles, or the discs may be used for driving the bobbins or spindles, while the building of the yarn or thread on the bobbins or spindles is effected by pressers of the usual construction; also in varying the speed of the bobbins or spindles and yarn guides according to the increasing diameter of the yarn or thread wound on the bobbins. *Patent completed.*

396. C. R. MOATE. "Improvements in the manufacture of nuts, screw-bolts, spikes, and other headed fastenings." (A communication.) Dated Feb. 12, 1859.

This consists, under one head, in causing the shanks of headed fastenings to be burred or upset so as to cause a swell on the part on which the head is to be cast, and then a founderer's flask is prepared, in which a pattern is moulded, and in so much of the space which represents the shank the prepared shank before described is placed, and into the hollow in the sand or loam left for the head the melted iron is run in, which, uniting with the burred shank, completes the bolt, &c. *Patent abandoned.*

397. J. CRABTREE. "Improvements in the manufacture of bobbins and spools." Dated Feb. 12, 1859.

The object here is to form bobbins and spools of paper or cardboard, by which economy of cost and room, with considerable reduction of weight, are obtained. The inventor describes special apparatus for the purpose. *Patent abandoned.*

398. S. H. HUNTLY. "Improvements in cooking apparatus." Dated Feb. 12, 1859.

This consists of a combined cooking apparatus, by which the process of roasting, baking, steaming, and boiling may be carried on simultaneously. *Patent completed.*

399. T. WHITE and G. JENKINS. "Improvements in apparatus for raising and lowering ships along inclined slips." Dated Feb. 12, 1859.

This relates to a peculiar construction and arrangement of hydrostatic apparatus, whereby a continuous heaving action is obtained in raising or lowering ships from or into the water along an inclined slip. *Patent completed.*

400. J. and J. BENNETT. "An improvement in refrigerators for cooling beer and worts." Dated Feb. 12, 1859.

The object here is to obtain an extensive cooling surface in a refrigerator of a limited size. It consists in fitting two or more tiers of pipes in the refrigerator, and in connecting four or more of these pipes with the cold-water main, so arranged that the whole may be cleaned without difficulty. *Patent completed.*

401. G., G. W., and J. BETJEMANN. "Improvements in book slides." Dated Feb. 12, 1859.

This consists in fitting vulcanized caoutchouc or other springs to the underpart of the bottom of slides, in such manner that the side supports shall always return to the position from whence they have been drawn upon the extra book or books being taken from the slide. To ensure the action of the springs the patentees fix rollers at or near the outer end of the under part of the travelling slabs or of the flaps. These rollers prevent the slabs being pressed down out of the level with the bottom of the grooves in which the slabs travel, by the weight of the books which may be placed upon them. *Patent completed.*

402. W. G. RAWBONE. "Improvements in fire-arms and ordnance." Dated Feb. 12, 1859.

This consists in the formation of an elongated breech chamber, for the reception of the powder, of less diameter than that of the bore of the barrel, and in forming an annular shoulder in the front of this chamber for the projectile to rest upon, and thereby prevent the powder being compressed by the projectile being rammed down thereon. *Patent abandoned.*

403. G. T. BOUSFIELD. "Improvements in revivifying the scarlet colour of woollen cloth, lace, and embroidery, in use for military and other garments and furniture." (A communication) Dated Feb. 12, 1859.

To restore the wool to its original scarlet colour it is necessary only to apply the following composition:—citric acid, 300 grains; carbonate of potash, 150 grains; water, 7,500 grains. The citric acid is dissolved separately in 4,500 grains of water, and the carbonate of potash in 3,000 grains of water, after having first pounded each of these substances separately in a mortar to facilitate the solution. When the solution of each of these substances is complete the whole is mixed together; there is then obtained 7,500 grains of liquid composition suitable for restoring the colour of scarlet wool. *Patent abandoned.*

404. H. GARDNER. "Improvements in machinery for breaking and preparing flax and other fibres." Dated Feb. 12, 1859.

The patentee employs four breaking or crimping rollers arranged together in a frame. One of the rollers is placed in the centre, and the other three are ranged around and kept up to it by springs. The flax, straw, &c., is fed to the machine between the centre and the top roller; it afterwards passes between the centre roller and the two other rollers, and is brought back to and delivered on the same side of the machine as it was fed into it. The fibre as it passes from these rollers is caused to pass through a series of small grooved or plain rollers arranged in pairs, the upper and lower roller of each pair being pressed towards each other by springs. These rollers are mounted in two separate frames, each frame carrying every alternate pair. One of the frames has an up and down motion communicated to it by a crank and connecting rod, or otherwise, and the rollers are thus caused so to rub the fibre as to make the woody parts of the straw already broken by the larger rollers to fall out. *Patent completed.*

405. R. BELL. "Improvements in separating and recovering wool from fabrics composed of wool, or wool in connection with cotton and other vegetable substances." Dated Feb. 12, 1859.

The patentee takes muriate of manganese, such as is ordinarily obtained as a residuum in the manufacture of bleaching powder, in which state it is mixed more or less with chloride of iron. The rags, composed of rags and vegetable fibre, such as cotton or flax, are steeped in a solution of the above muriate of manganese, which rots or decomposes the vegetable and leaves uninjured the animal fibre therein. The two are then separated by processes well known. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Aug. 5, 1859.

1806. M. A. F. Mennons. A system of columns or monuments to be employed as sentry boxes, branch post and other offices, telegraph and fire-engine stations. (A communication.)

Dated Aug. 13, 1859.

1869. R. D. Clegg and T. Saunders. Improvements in locks.

Dated Aug. 23, 1859.

1926. W. H. Hill. An improvement in the manufacture of boxes or cases, and in fastenings for the same.

1928. W. Hollins and F. Hyde. Improvements in power looms for weaving, part of which improvements is also applicable to other machines driven by power.

1930. T. Richardson. Improvements in treating copper ores.

Dated Aug. 24, 1859.

1931. G. Pearson. Improved machinery for manufacturing boots and shoes.

1933. J. Henry and J. E. H. Andrew. Improvements in looms for weaving.

1934. J. Blake. Improvements in steam and vacuum gauges.

1935. D. Russell and J. Russell. Improving the means of docking and lifting ships out of the water for the purpose of examining and cleaning their bottoms, effecting any necessary repairs, fixing new screw propeller, rudder, raising sunken vessels, or any thing else for which it is desirable to get at any portion of a vessel generally under water.

1936. T. Briggs. Improvements in the manufacture of tarpauling.

1937. J. Murray. Improvements in the preparation and bottling or preserving of carbonated cod liver oil and other aërated liquids.

1938. C. T. Judkins. Improvements in sewing machines.

Dated Aug. 25, 1859.

1939. H. Smith and T. W. Ashby. An improved construction of harrow. (A communication.)

1940. L. Perkins. Improvements in mills. (A communication.)

1941. A. P. Chamberlain. Improvements in machinery or apparatus for cutting cork, part of which improvements is also applicable to cutting paper, caoutchouc, and other substances.

Dated Aug. 26, 1859.

1943. J. Furrell. A lock protector, consisting of an adhesive shield or cover to be placed over the key-hole of a lock for the purpose of ensuring that any access to the interior of the lock shall be readily detected.

1945. T. Bird. Improvements in castors.

1946. J. M. Hetherington. Improvements in machinery or apparatus for carding cotton, wool, and other fibrous materials.

1947. H. Grundt. Improvements in life-boats.

1948. W. MacLellan. Improvements in rolling or shaping iron for railway spikes and other purposes.

1949. C. T. Boutet. A new mechanical mill proper for milling every sort of grains, dried or torrefied, such as coffee and cocoa.

Dated Aug. 27, 1859.

1950. C. Hanson. An improvement in the chronometer escapement of a watch.

1951. F. Wrigley. Certain improvements in the construction of the permanent way of railways.

1952. J. R. Rostron. Improvements in furnace bars.

1953. W. H. Balmain. Improvements in the manufacture of glass, and other vitrified substances.

1954. T. Craven. Improvements in ball cocks or valves.

1955. G. Bell. Improvements in reaping and mowing machines.

1956. J. Heckethorn. Improvements in candles

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and wicks, also in lamps or candlesticks for using with the same.

1958. E. Rettig. Improvements in the form and construction of anchors. (Partly a communication.)

Dated Aug. 29, 1859.

1960. T. Meriton. Improvements in governors for regulating the speed of marine and other engines and machinery.

1961. C. Kerman. An apparatus to prevent the sinking of vessels through leakage, for lifting and floating vessels off when stranded, and for raising and floating sunken vessels.

1962. J. R. Howarth. Certain improvements in machinery or apparatus for calendering and finishing textile fabrics or other surfaces.

1963. W. Clark. Certain improvements in sewing and stitching by machinery. (A communication.)

1965. D. Todd. Improvements in machinery or apparatus for carding and treating or preparing fibrous materials.

1966. B. Baugh. Certain improved machinery or mechanical arrangements for raising or giving form to articles formed of sheet metal, such as knobs, thimbles, ferrules, and parts of umbrella and parasol furniture, button shells, and other such like small articles.

1967. G. S. Fleming. A head-rest, suitable for keeping the head in a comfortable position in travelling, sitting, or lying down.

Dated Aug. 30, 1859.

1969. J. B. Barnes and J. Loach. Certain improvements in oars for impelling boats, as also in the rowlocks in which they work.

1971. J. Hare. Improvements in pianofortes.

1975. C. and J. Chambers. Improvements in apparatus for sawing staves and other forms of wood.

1977. R. F. and E. Drury. Improvements in vices.

Dated Aug. 31, 1859.

1979. J. Nuttall. Certain improvements in and applicable to, machinery used in preparing and spinning cotton and other fibrous materials.

1981. R. Beverley. Improvements in wet gas meters.

1983. S. Middleton. Improvements in the mode or method of uniting and otherwise manufacturing articles of leather, and such like materials, and in the apparatus and machinery connected therewith.

1985. A. Smith. Improvements in machinery for the preparation of cocoa nut fibre.

1991. J. Chatterton. Improvements in the manufacture of tubes of gutta percha, and other substances capable of being moulded in a similar manner when in a plastic state, and also in coating wire and other cores with such substances.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

2032. J. J. Sieber. Improvements in power looms. (A communication.) Dated Sept. 6, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Sept.* 13, 1859.)

1093. A. Jumelais. Obtaining power.

1094. J. Ferguson and J. McGaveny. Fasteners.

1097. J. Basford. Expressing clay through dies.

1102. C. Nuttall. Grinding wire cards.

1103. F. W. Emerson. Treating ores.

1114. E. W. Scale. Railway-signals.

1128. E. T. Hughes. Sheet iron. (A communication.)

1131. H. Reynolds. Refining sugar.

1137. W. Kellingley. Lubricating journals.

1140. S. Wright. Gas regulator.

1149. M. Henry. Fastenings. (A communication.)

1157. J. Ramsbottom. Printing fabrics.

1170. M. Defries. Regulating the pressure of gas.

1174. M. Henry. Heating and supplying air. (A communication.)

1176. W. O. Bourne. Separating substances of different specific gravities.

1185. W. Spence. Knapsacks. (A communication.)

1188. J. B. Lyall and F. W. Campin. Omnibuses.

1214. S. C. Sheard. Fire-bars.

1223. J. Brown, jun. Buffers and springs.

1242. R. Wilson. Hydraulic machinery.

1257. W. H. Perkin and M. Gray. Mordanting and dyeing.

1278. J. C. Fisher. Paints and varnishes.

1305. W. H. Nevill. Steel and wrought iron.

1330. G. Smith. Hat bands.

1540. A. V. Newton. Cutting corks. (A communication.)

1567. B. Standen. Deodorizing feeal matters.

1628. J. H. Johnson. Shaping metals. (A communication.)

1768. A. B. Seithen. Cases, hampers, &c.

1770. H. J. Newcombe. Warming buildings.

1812. W. R. Drake. Telegraphing and sounding. (A communication.)

1848. J. Waite. Making infusions.

1896. S. Beardmore. Electric batteries.

1915. W. A. Vérel. Manure.

1919. Hon. W. Talbot. Cigar lighter.

1965. D. Todd. Carding fibrous materials.

2032. J. J. Sieber. Power looms. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Sept. 8, 1859.

613. J. Erwood and J. Skertchly.
621. J. Yuill.
623. H. Lodge.
627. S. Wheateroft.
629. F. Clark.
635. J. T. Calow.
636. J. Thornton.
637. J. Court.
638. R. Allison.
639. J. Macnab.
640. R. Waller.
641. R. A. Brooman.
644. D. Joy.
649. W. Langton.
668. J. Clark.
670. H. Bessemer.
722. W. Weild.
753. W. Clark.
772. C. J. Richardson.
778. T. Carr.
1042. T. Holt and J. Brown.
1347. A. Suter.
1454. A. V. Newton.
1527. W. E. Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2087. F. Estivant.
2089. J. Fowler, jun.
2093. F. M. Herring.
2095. W. Petrie.
2113. J. Taylor.
2126. J. Milnes and W. Thompson.
2129. A. Chaplin.
2130. A. D. Bishop.
2140. J. Elliott.
2144. R. Peyton.
2149. C. Hill.
2150. S. C. Lister.
2165. G. T. Bousfield.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Sept. 9, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
148	0 6	315	0 3	328	0 10	342	0 6	356	0 9	373	1 4
251	0 3	316	0 3	329	0 3	343	1 9	357	0 10	374	0 7
285	0 3	317	0 10	330	0 5	344	0 3	358	0 3	375	0 3
304	0 10	318	0 3	331	0 3	345	0 3	359	0 10	377	0 9
305	0 7	319	0 3	332	0 8	346	1 1	360	0 3	381	0 3
306	0 3	320	0 6	333	0 7	347	0 7	361	0 8	382	0 3
307	0 6	321	0 3	334	0 3	348	0 3	362	0 7	384	0 3
308	0 3	322	0 7	335	0 3	349	0 3	363	0 3	385	0 3
309	0 6	323	0 3	336	0 10	350	0 4	364	0 3	389	0 3
310	0 4	324	0 3	337	0 3	352	0 6	366	0 3	392	0 3
311	0 9	325	0 7	339	0 3	353	0 3	368	1 4	395	0 10
312	0 10	326	1 9	340	0 3	354	0 3	369	0 7	396	0 3
313	0 3	327	0 3	341	0 3	355	0 6	371	0 3	418	0 4
314	1 4										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

CONTRACTORS' RAILS, &c., *Scotland.*—About 42 lbs. per yard; also earth-waggons, and 2 ft. 6 in. wrought-iron wheels and axles. Apply, Mr. W. Thompson, contractor, Hawick.

RAILWAY STORES, *Ireland.*—For the Waterford and Limerick Railway, in such quantities as they may require in the year commencing Oct. 1. To include iron (bar and plate); boiler tubes for engines (iron), and feed-pipes; nails, steel, files, and tools; chairs and sleepers; keys, trenails, and screw augurs; timber, &c. Particulars and forms, Sept. 20 inclusive, Waterford Terminus.

COPPER, *Navy.*—For the Chatham Dockyard; in ingots of 112 lbs. each, 60 tons; in ingots of 140 lbs. each, 65 tons; tough cake, 15 tons; copper cakes about 14 lbs. each, without lead, 30 tons. Conditions and forms, Somerset-place, London. Tenders, 2 o'clock Sept. 20.

SEWERAGE, *Leamington.*—4,250 lineal yards of brick sewers, for the outfall drainage of the district, the construction of works for the defecation or deodorisation of the sewerage therefrom, the alteration, diversion, & improvement of the river Leam, between the Adelaide-bridge, at Leamington, and the river Avon at Armscote, in the borough of Warwick; the construction of a weir across the said river, and other works connected with the above. Plans, and bills of quantities, and further particulars, on application to Mr. Morgan, surveyor to the Local Board of Health, Town-hall, Leamington. Specification and form of tender on application to the clerk's office, Town-hall, on payment of 10s. Tenders to Sept. 26.

RESERVOIR EMBANKMENT, &c., *Hallicroll*, near *Bolton.*—Plans, sections, and specifications, office of Mr. H. Eaton, Mount Sion, Radcliffe, near Manchester. Tenders to the 28th inst.

LIGHTHOUSE LANTHERN, *Trinity House.*—For the Dungeness Lighthouse. Forms, specifications, &c., of the Corporation of Trinity House, London, up to 24th inst. Tenders, Sept. 27.

COAST-GUARD STATION, *Ireland.*—At Clontarf, in the County of Dublin. Plans, &c., Board of Public Works, Dublin. Each proposal to be for a lump sum, and to be accompanied by a detail giving quantities and prices.

CHURCH TOWER, *Ireland.*—To the Roman Catholic church at Dunmore, County Galway. Plans, elevations, &c., by Mr. J. S. Butler, architect, 16 Hume-street, Dublin. Plans at the residence of the parish priest, Dunmore; or of the architect; where tenders, Sept. 23.

PRISON, *Galway.*—For adapting present county prison to the separate system of confinement. Plans, &c., Mr. S. U. Roberts, county surveyor. Tenders to the Chairman of the Board of Superintendence per the governor of the gaol, Sept. 24.

CHURCH WORK, *Ireland.*—For repairing and painting externally the churches of St. George (Belfast), Kilcoeriold (Ballymena); St. Matthew, Lisburn (Broomhedge); all County Antrim. Loughgilly and Middleton, County Armagh. Ballyeawley, County Tyrone. For repairing the churches of Drumachose (Newtownlimavady) County Derry. Fahau Lower (Buncrana), County Donegal. And Ross, County Mayo. All according to specifications, with the resident ministers of the parishes. Tenders to Ecclesiastical Commissioners for Ireland, 21 Upper Merrion-street, Dublin, Sept. 23.

CHURCH RESTORATION, *Hemel Hampstead.*—Plans, Mr. White, vicar's churchwarden, and office of Mr. Christian, 10 Whitehall-place. Tenders to Sept. 26th.

WORKHOUSE, *East Grinstead.*—For the erection of a new union workhouse, at East Grinstead, Sussex. Drawings, specifications, quantities, Messrs. Peck and Stevens, High-street, Maidstone. Tenders to Mr. W. Head, clerk to guardians, East Grinstead, Sept. 22.

CHAPEL, *Southport.*—Drawings and specifications at office of the architects, Messrs. Hayley and Son, Cross-street, Manchester. Tenders to Sept. 20th.

SCHOOLS, *Neath Abbey.*—Plans for alteration of the British schools, at office of the Neath Abbey Iron Company, or of Mr. Richardson, C.E., Queen-street, Neath. Tenders to Sept 21st.

SCHOOLROOM, &c., *Christchurch, Hants.*—Plans and information at the Royal Engineer's office, Gosport. Tenders to Sept. 19th.

TOWN-HALL, *Newcastle-under-Lyme.*—Plans for remodelling, copies of quantities, and other information at offices of Messrs. Ward and Son, architects, Hanley. Tenders to Sept. 24th.

MANAGER OF COPPER AND IRON WORKS.—The office of resident manager of the coal, iron, copper, smelting, and tin-plate works, at Crom Avon, in South Wales, belonging to the Governor and Company of Copper Miners in England, will become vacant in a few months. A deputy manager is also required. Similar previous occupation necessary. Application to the Court of Assistants, 10 New Broad-street Mews, London, Charles Frewer, Secretary.

TRAVELLER.—For engineering tools. Address, stating age and salary, with references, to B., 79 Post-office, Leeds.

PRICES CURRENT OF METALS.

London, Sept. 16*th*, 1859.

		£ s. d.		£ s. d.	Per
IRON:					
Rails in Wales and North of England	pr. ton	6 0 0	to	6 0 0	nett
Welsh Bars, in Wales	"	5 17 6	"	6 0 0	"
Staf. Bars, at the Works	"	7 0 0	"	7 10 0	"
" Hoops	"	8 0 0	"	9 10 0	"
" Sheets, Singles	"	8 10 0	"	9 0 0	"
" Nail Rods	"	7 0 0	"	7 10 0	"
" Boiler Plates	"	8 10 0	"	9 0 0	"
Scotch Pig, M.N.'s, Warrants, at Glasgow	"	2 11 9	"	2 12 0	nett
Do. No. 1, Good Brands	"	2 11 0	"	2 12 0	"
Scotch Bars	"	7 10 0	"	8 0 0	"
Swedish Bars, in London	"	12 0 0	"	13 0 0	"
COPPER:					
Sheet and Sheathing	per lb.	0 0 12	"	0 0 0	"
Tough Cake and Tile	pr. ton	107 10 0	"	0 0 0	"
Best Selected	"	110 10 0	"	0 0 0	"
Australian	"	110 0 0	"	110 10 0	"
South American	"	103 0 0	"	0 0 0	"
Yellow Metal Sheathing	per lb.	0 0 10	"	0 0 0	"
STEEL:					
Swedish Keg	pr. ton	19 0 0	"	0 0 0	"
" Faggot	"	24 0 0	"	0 0 0	"
TIN:					
English, Block	p. cwt.	6 16 0	"	0 0 0	"
" Bar	"	6 17 0	"	0 0 0	"
Foreign, Banca	"	7 3 0	"	0 0 0	nett
" Straits	"	7 0 0	"	0 0 0	"
TINPLATES:					
Charcoal, I.C.	pr. box	1 12 6	"	1 13 6	"
Coke, I.C.	"	1 6 6	"	1 7 6	"
LEAD:					
Pig, English	pr. ton	22 10 0	"	23 0 0	"
" Spanish	"	22 0 0	"	22 10 0	"
Sheet	"	24 10 0	"	24 0 0	"
SPELTER:					
On the spot	"	20 10 0	"	21 0 0	nett
For arrival	"	21 0 0	"	21 5 0	"
ZINC:					
English Sheet	"	26 0 0	"	27 0 0	"
QUICKSILVER	pr. btl.	7 0 0	"	0 0 0	"

REMARKS.—We are unable to report any improvement of business in Metals. Our Markets continue very quiet.

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 23, 1859.

THE GREAT EASTERN EXPLOSION.

INTO what a weltering flood of pros and cons, questionings and cross-questionings, swearings and counter-swearings, have we to plunge in entering once more upon this subject! It is only because we know that above the weltering flood the simple truth is securely floating, and because we hope to bring that safely to land, that we make the plunge, and strike out towards our object.

For the outside reader who has nothing to guide him but such reports as the newspapers have been enabled to publish, and who has no time to peruse even them with studied care, the simplest and most natural thing to do is to fix the blame impetuously upon either Mr. Scott Russell on the one side, or upon the Company (in which are included nearly all the remaining witnesses at the inquest) upon the other, and then cast the whole question out of his mind, and have done with it. But as there are persons who wish to look deeper into the matter than the newspapers can possibly admit them, and who have the time and patience to dig even to the bottom of it for the truth, and who, moreover, are too much alive to the justice that is due from man to man either to put the blame of one man upon a dozen, or to heap the blame of a dozen upon one—as there are such persons, we say, it becomes incumbent upon us to set about unravelling the mystery, and displaying the truth, of this very sad affair. To do this we must in the first place advert to a few facts antecedent to the late trip to Portland.

Every one will remember that early in the month of August last two notable celebrations took place on board the Great Eastern at Deptford. In those celebrations the Chairman and Directors of the Great Ship Company joined, making speeches themselves, accepting eulogies from Lord Stanley and others, and subsequently receiving a written acknowledgment of their enterprise from numerous members of the House of Commons. Now, what was the avowed occasion of those celebrations? This—and let the reader mark it carefully—the *completion* of Mr. Scott Russell's contract for finishing the ship (in so far as she was then to be finished) in a certain number of weeks! Mr. Campbell and Mr. Jackson, M.P.—the Chairman and the Deputy-Chairman—distinctly and lavishly eulogised Mr. Scott Russell for the admirable zeal and skill which he had shown in performing what he had undertaken.

Again: towards the end of August, a general meeting of the shareholders of the Great Ship Company was held, and during it Mr. Jackson, M.P., made a speech which was very generally published. From that speech we extract the following passage. After explaining how it was that the contract came to be given to Mr. Scott Russell, Mr. Jackson proceeded:—"And "now, instead of the work occupying six "months, as Mr. Brunel anticipated, it has been "*completed* in four months; during which time "as much work has been done as required in "building a 120-gun ship. I say, if any man "retrieved a position, and came out gloriously, "it is Mr. Scott Russell. The work that he "has done is incredible. Such an example of "what can be effected by mind and muscle is "unsurpassed." Mark the first sentence: "it "has been *completed* in four months"—that is Mr. Jackson's statement in August.

Again: several days before the Great Eastern left the Thames we met Mr. Scott Russell in Great George-street, Westminster. The ship was, of course, spoken of, as was the approaching trial trip also; and one of the remarks of Mr. Russell was, "the Company have invited "me, and have authorised me to invite a limited "number of my friends." The fact was stated as a simple and natural one, and of course accorded fully with the knowledge we had of the contract's previous completion.

Further: the day before the ship left her moorings at Deptford, we went on board and met Mr. Russell there. To our suggestion that we feared he must be exceedingly busy, he replied that, on the contrary, he had little or nothing to do, those of his men who were on board being lent to the Company, and not employed on any business of his.

Before we separated from Mr. Russell on the last-named occasion, a gentleman belonging to Messrs. Boulton and Watt's firm (the makers of the screw-engines) joined us, and to him Mr. Russell made some observations to which late events have given great importance in our minds, as they bear directly upon the much-vexed question of Mr. Russell's position during the late trip. They were to the following effect, although we cannot, of course, report them verbatim: "As I shall be on board," said he, "and we must all do what we can, I think "the best thing I can do will be to go upon the "paddle-bridge, and prevent any wrong or mis-"taken instructions being given to my engines. "I think you had better do the same. We can "then see that the engines are not pushed too "much for the first day or two. You know, to-"morrow is not a trial trip at all. The business "of to-morrow is to get the ship round to Port-"land, and nothing else. But if we don't keep "our own eyes upon our engines something "may go wrong, and for the sake of all parties "we must avoid that. Perhaps it may be a "convenience to Captain Harrison if I take the "engine-room telegraph and myself send every "message down for him; no one will complain "of our assistance." This, we say with perfect certainty, was the tenor of Mr. Russell's observations; and in reply, the gentleman spoken to said he thought highly of Mr. Russell's proposal, and suggested that as the telegraph to the screw-engine room was within a few feet of the other, Mr. Russell might do his firm good service by working both of them. The whole conversation of course implied that Mr. Russell believed he had no duties and no responsibilities resting upon him in the way of business; but that he felt anxious to assist the owners and officers of the ship, and that he could do this best by guarding the engines which he had built for them from being subjected to any accidents from above. When it is remembered that there was to be a captain and two pilots on board—that the navigation down the river was certain to be most intricate, occasioning many turnings ahead and astern—that the ship was of an immense length, so that the pilot in the bows might think it necessary to send instructions aft on his own responsibility—that for the first time both screw and paddle-engines were to be worked together in the same ship—and that a hundred or two of passengers might all be crowding round the officers of the ship and round the engine-room at once—it will be seen that Mr. Russell's determination was a most wise and important one. It will also, we think, be observed that it involved no sort of responsibility beyond that of seeing that when the engines were to be turned ahead they were not turned astern—that when they were to be put on to half-speed they were not put on to full-speed—and so forth. By no ingenuity, however subtle, can it be said to have saddled him with the charge of the officers and men down in the boiler-rooms.

Now, from the moment the voyage was commenced at Deptford down to the time of the explosion, Mr. Russell managed *both* telegraphs, as he had proposed to do, and managed them with greater assiduity and care than any other man could have been expected to evince. That in doing this he sometimes refused to press the engines quite as much as some of the many official persons on board desired, is in no way inconsistent with the simple and voluntary service which he was rendering; nor does the fact in any way prove that he had "charge" of the engines in any other than a very limited sense of that term. It was, as we said in our letter written from the ship at Purfleet, the mere "working" of the engines that was temporarily under his control, and by no means the engines themselves, much less the boilers.

Having thus stated what we personally *know*, beyond all controversy, in the matter, we turn to the evidence given at the inquest. And in doing this we must take with us two hypotheses: 1, That Mr. Scott Russell was supposed to have completed his contract, and was on board the ship as the guest of the Directors, lending useful assistance, but in no sense exercising authority over the Company's staff of engineers or over the apparatus under their care; 2, That his contract was not completed, that the engines were not the Company's but his own, and that he had full authority over both men and apparatus. One of these hypotheses must stand; the other must fall to the ground: which is to stand, and which fall?

Before answering this question we must observe that both Mr. Russell and the Company appear to have been guilty of much business laxity or the question at issue could never have been raised. There should have been fewer verbal, and more written, understandings between them. Had the Company been less satisfied with Mr. Russell, or had he been less trustful of them, this would undoubtedly have been the case. As it was, they each trusted the other, implicitly but most unwisely, and the consequences of their mutual reliance are before us. Still, it should be understood that it was confidence, and not mistrust, which led to the present perplexities. But those perplexities are not the less on that account. The absence of everything but tacit understandings has left all the principals concerned in the ship free to swear just as they pleased, or as their feelings, rather than their knowledge, dictated. Hence we have the Chairman of the Company, the Deputy-Chairman, the Captain of the ship and the Chief Engineer of the ship, all of course swearing on one side; and on the other side Mr. Russell swearing for himself. Had the interests been reversed, who knows with how little difficulty some, at least, might have taken views opposed to their present evidence, without in any way violating their consciences?

In our judgment, therefore, the evidence tendered at the inquest carries but exceedingly little weight with it, and will scarcely help us at all to arrive at a choice of one or other of the hypotheses which we have before us. It seems to be admitted by all parties, however, that the whole staff of engineers who were in attendance upon the boilers and engines were in the Company's pay, and had signed the ship's articles. They were therefore under Mr. M'Lennan's orders. Mr. M'Lennan, it is true, washes his hands clean of all charge of them by saying that he committed the care and the responsibility of them to Mr. Dixon—Mr. Russell's manager! But he does not say that he had specific authority, or indeed any authority, for doing this,

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and only justifies the proceeding by saying that Mr. Brunel and Mr. Campbell had given him general instructions to let the contractors alone. So that we really must consider them under his charge, and regret that he should ever for a moment have considered otherwise.

As to Mr. Dixon, he unquestionably was a good deal in the paddle engine-room; but then he was equally in the dining-saloon among Mr. Russell's friends, and dined at the same table as ourselves only an hour or two before the accident. No one, perhaps, saw more of the active assistance which he rendered at times than we; but we all the time understood perfectly well that he was doing what he did voluntarily, and from a desire to aid the officers of the ship, as his employer was aiding them, to the best of his ability.

Which hypothesis, then, are we to adopt? We state frankly, and without reserve, that we can accept the first only. Where evidence "in "black and white" cannot be produced, facts may be strangely transformed to serve useful purposes. But even if this question should be taken into a court of law, and it should be there decided that Mr. Russell's business on board the ship was not completed when she left the Thames, we should still believe that its completion had been tacitly acknowledged by the Company. Indeed, have we not already recited the acts and words of the heads of the Company to that effect?

With the facts which we have laid before them in their possession, our readers will know what value to attach to the letters of Mr. J. H. Dillon and some others who have written to the *Times*, saying that they saw Mr. Scott Russell giving orders on board the ship. They may have believed they were exposing some terrible discrepancies; but all they saw was perfectly consistent with the view we have taken of the matter—or rather, not the view which we have taken, but that which has been forced upon us by our own senses.

The preceding portion of this article was written on Wednesday evening. This day, Thursday, we find in the *Times* the following letter sent up by Mr. Scott Russell from Weymouth. How entirely it coincides with all that we have stated will be seen at a glance:—

Sir,—I observe in the *Times* of to-day letters from "A Passenger-Shareholder" and from "Spectator," pretending to contradict my evidence and Mr. Dixon's regarding the part I took, and the part I did not take, in the management of the paddle-wheel engines; and I find another from a Mr. Dillon, of a previous date.

I frankly admit that I communicated probably 100 messages, in the course of the voyage, from the bridge to the paddle-engine room.

I as readily admit that my chief assistant was in the paddle-engine room, giving all the assistance in his power to carry the orders I transmitted into effect.

I equally admit that my son Norman assisted me in transmitting some of those messages, and that he counted for me the strokes of the engines, and reported to me every five minutes their condition and speed.

It is perfectly true that at one time the screw-engines went faster than the paddle-wheel engines, and at another time the paddle-wheel engines faster than the screw.

But all your correspondents have omitted to state (what they could equally have stated if they were competent witnesses and wished to be just), that I transmitted the same number of orders in the same manner to the screw-engines, which were not made by me, and where no engineer of mine was assisting.

The fact is I merely worked the telegraph, and transmitted the necessary instructions to both engines from the pilot and captain, in such a manner as would best give effect to their wishes, and cause the vessel to perform the evolutions they desired.

But is it just or fair to argue from such circumstances that I was in responsible charge of the working of both sets of engines? I am sure Mr. Blake will not say I was responsible for his engines because I concerted telegraph arrangements with him.

I may further state that I did not go into either engine-room, and I could not even see the paddle-engines work from where I stood. My engines, and, as I imagine, those of Messrs. Watt and Co., were in the hands of the company's engineers serving under the ship's articles. Out of 170 persons, servants of the Company, employed on the engines and boilers, only four were appointed by the Company on my recommendation, and an equal number on Messrs. Watt and Co's recommendation.

Had the paddle-engines remained my property; had they been worked on my responsibility; had the trial trips been in any degree mine, I should have taken upon myself the entire and absolute control of the whole paddle-wheel and boiler department, and should not have permitted any one to touch either engines or boilers who had not been absolutely appointed by me, and been solely responsible to me. As it was, the Company refused my offer to recommend to them competent persons for the entire staff of the paddle-wheel engines and boilers, and only accepted my recommendation for the appointment of their first four engineers.

The management of the engines and boilers being thus placed in the hands of the Company's own servants, all I could do was to render the utmost assistance in my power, as every maker of engines naturally would do, when he had the opportunity, in a work of extraordinary magnitude.

I remain, Sir, your obedient servant,

J. SCOTT RUSSELL.

Weymouth, Sept. 20.

We shall not pursue this subject further. We should perhaps have satisfied some few readers better if we had said less, and had let the chivalrous Directors and officers of the Company heap the blame of this unhappy affair upon the man whom they lately combined to extol. But it is not for us to see a distinguished engineer and shipbuilder made a scapegoat of commercial mismanagement. The professions made by Mr. Scott Russell, both privately and publicly, have been perfectly consistent from the time of the great celebrations in August down to the very moment of the explosion. The professions made by the Company's Directors are not so; much of what they have declared at Weymouth in September being in flat opposition to what they said at Deptford and London in August. As it is our duty to make known the rights of the matter, we can do no other than support the man who has both truth and consistency on his side.

As to the purely scientific aspect of the case, there is little to be gleaned either from the inquiry at Weymouth or from the explosion itself. If, as seems to be the case, the "tap" was shut, we need no theories of steam-decomposition to account for the explosion and its effects. If the tap was open, as Mr. Russell in his evidence said it may possibly have been, then the sudden admission of cold water upon the over-heated plates of the water-vessel, and the consequent flashing-up of more steam than the stand-pipe could carry off, was in all probability the occasion of the accident. Neither hypothesis offers anything new to science. Terrible explosions are frequently occurring from both causes, and no amount of parade which we might make—by engraving sketches of the funnel and casing, or by other means—would serve scientific men one bit.

The practical result of the whole disaster should be,—better management on board the Great Eastern. Turn the sworn evidence how we may, we cannot escape the conviction that the management of the ship was a sad bungle. There were far too many masters on board, and too great a disposition to make other people masters. Because Mr. Russell went up to the paddle-bridge telegraphs, half-a-dozen of the responsible officers of the ship straightway declare him master of 170 of the Company's servants! Because Dixon lends a helping hand at the engines, the chief engineer of the ship declares him master of all the men around him! This sort of thing will not do. Let Captain Harrison at once become supreme on board, and after appointing every other man to his work, inflexibly insist upon his doing it.

SIR HOWARD DOUGLAS'S IMPROVEMENT OF THE SCREW PROPELLER.

We have had so little leisure lately that we have been unable to do an act of justice which seems in fairness to be demanded of us—that of defending the gallant and veteran Sir Howard Douglas from the attack which Mr. Robert Griffiths made upon him on the 2nd inst. in the columns of the leading journal.

On the 27th of August an elaborate article appeared in the *Times* in commendation of Sir Howard's improvements in the screw propeller, the greater portion of which article was quoted in our columns. Three days afterwards Mr. Griffiths replied in the letter of which we complain. Had his remarks been confined to the fact that in the *Times'* retrospect of the progress of screw propulsion no mention had been made of his improvements we should, of course, have nothing to say against them; nor should we, indeed, had he further stated that in his propellers the blades were of a form somewhat resembling that recommended by Sir Howard. But when Mr. Griffiths has the boldness to claim under his patent of 1849 precisely what Sir Howard has proposed, and further menaces Sir Howard with litigation if he ventures to proceed with his plans, it becomes necessary for us to inform the public that Mr. Griffiths is going beyond his legitimate bounds.

Mr. Griffiths' propeller, and his patents also, are of course familiar to us; but in order that we might speak with perfect confidence upon the subject we have taken the pains to refer to the specifications of his patents, and we now say in all confidence that these patents give him no right whatever to interfere with Sir Howard's modification of the Admiralty screw. If he thinks they do, he is mistaken, and his threat of legal proceedings amounts to nothing. But even if Mr. Griffiths were justified in a legal sense in thus threatening the gallant General, one would have thought that the distinct avowal of the *Times*—to the effect that Sir Howard would steadfastly refuse all pecuniary interest in the matter—would have saved so valuable and aged an officer from Mr. Griffiths' menace. But it requires a finer sense of honour than Mr. Griffiths seems to possess to understand even such an avowal as that properly; to him it was only a proof that Sir Howard is "liberal of other people's property"—a charge which a sensible man would have been very slow indeed to bring against Sir Howard Douglas!.

Mr. Griffiths concludes his letter by suggesting to Sir Howard that he should "familiarise "himself with what has been done by others," and "avoid being misled by interested patent "agents and injudicious friends." This is certainly not very polite or modest language, coming from a man like Mr. Griffiths to a man like Sir Howard Douglas! We should like to know how many readers of the *Times* read it with approbation. But its want of candour, which few readers only will detect, is even worse than its want of good taste, which every one must observe; for Sir Howard might have read Mr. Griffiths' specification over and over all the rest of his days and never have found occasion to alter or extend his own published views upon the screw in the slightest degree. As to the suggestion about interested patent agents—if that be intended to refer to us as the earliest advocates of Sir Howard's improvements, it can be answered at once by saying that Sir Howard is not, nor ever was, a client of ours. We never

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performed a single business transaction with him in reference either to this or any other subject. We hope this plain assurance will fully satisfy the delicate mind of Mr. Griffiths.

A CHINESE LESSON ON NATIONAL DEFENCE.

We cannot afford to lose 464 men in the mud of a Chinese river without some kind of recompense, and perhaps the very best kind possible is that of drawing a lesson on river defence from the late disaster. We think we see a very important one that may be drawn from it, viz., that we may with confidence trust for the defence of English rivers to local gun-rafts in conjunction with booms, chains, stakes, or other like obstructions.

What have we seen on the Peiho? This: that a fleet of gun-boats, however gallantly handled, may speedily be crushed by the fire of batteries—if they can only be stopped for a time within range. Had the river been clear of obstructions, the little squadron would doubtless have run the gauntlet of the forts without serious injury, in the same manner as our light vessels passed within range of many a Russian fort in the Sea of Azoff during the late war, without losing a man. This even the Chinese knew, and therefore brought our gunboats to rest under their guns by the stakes of which we have heard so much, and then cut them up at will. But—it has been said—the attack was badly planned; the cart was put before the horse; the forts should have been taken in reverse by a land force before the steamers were brought within range. That is doubtless correct enough. But suppose the forts had been gun-rafts, stationed afloat above the stakes, inaccessible to a land force, and so as to concentrate their fire upon the stakes: by what mode of procedure could these have been silenced? By none whatever save that adopted by Admiral Hope, which ended so disastrously.

Here, then, is instruction, and hope too, for us who are so often alarming ourselves about squadrons of French gunboats ascending the Thames and levying contributions upon London. A few heaps of stakes piled upon the banks, with a few dozens of casks, fathoms of rope, and other simple stores by the side of them, together with a supply of guns and gunners, and our riverside towns may in a day be made as safe as art can make them!

As this suggestion may be carried out so very simply and cheaply no notice will, we presume, be taken of it. Yet it is not without the sanction of professional men of eminence. The foremost of those who advocate it is Captain Cowper Phipps Coles, R.N., who "knocked the "Lady Nancy raft together in a night," and with her "went in and burnt Taganrog," and thus inspired Punch's famous song, beginning—

"O jaw till you're frantic of wessels gigantic,
With hundreds of guns, and with thousands of crew,
Jack's want 's of the oddest, a wessel so modest
As just does the work as he wants her to do—
He doesn't condemn none, your big Agamemnon,
Your Dukes and your Alberts, as long as a street;
They're mighty imposing, but when he's for closing,
A taut Lady Nancy is worth the whole fleet."

This able officer has, as we have stated in a previous article, published a pamphlet on the subject. This can be had at Messrs. Clowes and Sons, Charing-cross, and we recommend our readers to get it. A few words from men of experience in such matters is worth volumes of mere speculations; and we hope Captain Coles will speak out even yet more fully upon this important question, especially as he has already promised "a future pamphlet." If we are determined to spend millions on doubtful defences, it will still be well to know how reliable ones may be secured for next to nothing.

FOREMEN ENGINEERS.

Many of the master-engineers, master-shipbuilders, and other masters in this country are undoubtedly among the ablest men of the age. Some of them have risen from the ranks of working-men; others have prepared themselves for their positions by prolonged study and observation; and many of both classes are doubtless unsurpassed in their professions. But, however able a master may be, if his business be large and flourishing we shall be sure to find, if we inquire, that its greatness and prosperity do not all spring from him. Beneath those great men whose names distinguish so many firms, there is another class who, to the world, are for the most part nameless, but to whom we really owe much of our manufacturing wealth and eminence. We allude to that strong-handed, clear-headed, noble class of men whom we call "foremen." These are they to whom the nation is mainly indebted for its ascendancy in almost all the useful arts. The Brunels and the Russells, the Lockes and the Stephensons, the Maudslays and the Penns, the Nasmyths and the Napiers, the Whitworths and the Fairbairns, the Lancasters and the Armstrongs, the Barrys and the Scotts—these are the men whose names are perpetually flashed in our faces as we look upon the great works that surround us; and it is with no grudging spirit that we behold their pre-eminence. At the same time it is but just that we should sometimes remember those less distinguished but equally honourable men from whose brains first springs many an idea which afterwards brings fame to their masters, and without whose skill we never could have won the position we now hold among the nations.

Our thoughts were turned afresh to this subject a few days since by a meeting of the Association of Foremen Engineers which we attended. It was a real interest in the Society that took us there, and it was with an increase of that interest that we retired from the gathering. We now advert to the event, not simply in response to the request which the excellent President of the Association—Mr. Joseph Newton (of the Royal Mint, we believe)—made to the scientific press, but because of the claims which foremen engineers have upon the regards of the public.

It would appear from what transpired on the occasion referred to (as will be seen from the report published on another page) that the officers of this Association have reason for believing that the employers view their proceedings with a certain amount of distrust. Their chief ground for their belief seems to be found in the fact that open and personal countenance of the Association is seldom manifested by the employers. We hope this has arisen from nothing worse than a misapprehension on their part. And in order to remove any such misapprehension, so far as is in our power, we would refer our readers in a sentence or two to the history of the Society. From the Secretary's report it appears that it was established seven years since, primarily as a foreman's benefit society. No questions of trade politics, or political economy have ever been discussed by its members, whose meetings, at the outset, were but mere friendly re-unions. More recently, however, they have met with a further object—the very laudable one of imparting to each other the benefit of their respective professional experiences, in the shape of scientific papers, read at monthly meetings. Surely there is nothing in all this but what employers should delight in and encourage!

For the future, then, we hope to hear no more of anything like distrust of this Association on the part of employers. On the contrary, we anticipate learning that employers are evincing both wisdom and good feeling by enrolling themselves as honorary members of the Association, and giving occasional attendance to its meetings. It is in every way most desirable that our really practical and experienced men—which these foremen, almost to a man, are—should be encouraged to communicate their knowledge to each other and to the world. It is a firm persuasion of ours that if all which foremen sometimes know were known also by masters, we should hear of fewer failures than we do. Masters often live in a region of ideas; but their foremen are for ever handling facts: and we know perfectly well that the former, unchecked by the latter, lead many a clever man astray. By all means, then, let us not only countenance the work of this Association, but further it in every way possible to us. Already nearly seventy members have undertaken to carry it on, and there are doubtless scores of patriotic foremen throughout the country who will be proud to share their labours and their honours. We hope soon to hear that they are doing so, and hope also that during the next year we may have an opportunity of enriching our columns with many valuable contributions from their pens.

THE PRINCE CONSORT ON SCIENCE:

BEING THE OPENING ADDRESS OF HIS ROYAL HIGHNESS THE PRINCE CONSORT TO THE BRITISH ASSOCIATION.

Gentlemen of the British Association,—Your kind invitation to me to undertake the office of your President for the ensuing year could not but startle me on its first announcement. The high position which science occupies, the vast number of distinguished men who labour in her sacred cause, and whose achievements, while spreading innumerable benefits, justly attract the admiration of mankind, contrasted strongly in my mind with the consciousness of my own insignificance in this respect. I, a simple admirer and would-be-student of science, to take the place of the chief and spokesman of the scientific men of the day, assembled in furtherance of their important objects!—the thing appeared to me impossible. Yet, on reflection, I came to the conclusion that, if not as a contributor to or director of your labours, I might still be useful to you, useful to science by accepting your offer. Remembering that this Association is a popular Association, not a secret confraternity of men jealously guarding the mysteries of their profession, but inviting the uninitiated, the public at large to join them, having as one of its objects to break down those imaginary and hurtful barriers which exist between men of science and so-called men of practice—I felt that I could, from the peculiar position in which Providence has placed me in this country, appear as the representative of that large public which profits by and admires your exertions, but is unable actively to join in them; that my election was an act of humility on your part, which to reject would have looked like false humility, that is, like pride, on mine. But I reflected further, and saw in my acceptance the means, of which necessarily so few are offered to Her Majesty, of testifying to you, through the instrumentality of her husband, that your labours are not unappreciated by your Sovereign, and that she wishes her people to know this as well as yourselves. Guided by these reflections, my choice was speedily made, for the path of duty lay straight before me.

If these, however, are the motives which have induced me to accept your flattering offer of the Presidency, a request on my part is hardly necessary that you will receive my efforts to fulfil its duties with kind indulgence.

If it were possible for anything to make me still more aware how much I stand in need of this indulgence, it is the recollection of the person whom I have to succeed as your President

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—a man of whom this country is justly proud, and whose name stands among the foremost of the naturalists in Europe for his patience in investigation, conscientiousness in observation, boldness of imagination, and acuteness in reasoning. You have no doubt listened with pleasure to his parting address, and I beg to thank him for the flattering manner in which he has alluded to me in it.

The Association meets for the first time to-day in these regions and in this ancient and interesting city. The poet, in his works of fiction, has to choose and anxiously to weigh where to lay his scene, knowing that, like the painter, he is thus laying in the background of his picture, which will give tone and colour to the whole. The stern and dry reality of life is governed by the same laws, and we are here living, feeling, and thinking under the influence of the local impressions of this northern seaport. The choice appears to me a good one. The travelling philosophers have had to come far, but in approaching the Highlands of Scotland they meet nature in its wild and primitive form, and nature is the object of their studies. The geologist will not find many novelties in yonder mountains, because he will stand there on the bare backbone of the globe, but the primary rocks, which stand out in their nakedness, exhibit the grandeur and beauty of their peculiar form, and in the splendid quarries of this neighbourhood are seen to peculiar advantage the closeness and hardness of their mass, and their inexhaustible supply for the use of man, made available by the application of new mechanical powers. On this primitive soil the botanist and zoologist will be attracted only by a limited range of plants and animals, but they are the very species which the extension of agriculture and increase of population are gradually driving out of many parts of the country. On those blue hills the red deer, in vast herds, holds undisturbed dominion over the wide heathery forest, until the sportsman, fatigued and unstrung by the busy life of the bustling town, invades the moor to regain health and vigour by measuring his strength with that of the antlered monarch of the hill. But, notwithstanding all his efforts to overcome an antagonist possessed of such superiority of power, swiftness, caution, and keenness of all the senses, the sportsman would find himself baffled had not science supplied him with the telescope and those terrible weapons which seem daily to progress in the precision with which they carry the deadly bullet, mocking distance, to the mark.

In return for the help which science has afforded him, the sportsman can supply the naturalist with many facts which he alone has opportunity of observing, and which may assist the solution of some interesting problems suggested by the life of the deer. Man also, the highest object of our study, is found in vigorous, healthy development, presenting a happy mixture of the Celt, Goth, Saxon, and Dane, acquiring his strength on the hills and the sea. The Aberdeen whaler braves the icy regions of the Polar Sea, to seek and to battle with the great monster of the deep: he has materially assisted in opening these icebound regions to the researches of science; he fearlessly aided in the search after Sir John Franklin and his gallant companions, whom their country sent forth on this mission, but to whom Providence, alas! has denied the reward of their labours, the return to their homes, to the affectionate embrace of their families and friends, and the acknowledgements of a grateful nation. The City of Aberdeen itself is rich in interest for the philosopher. Its two lately united Universities make it a seat of learning and science. The collection of antiquities, formed for the present occasion, enables him to dive into olden times, and, by contact with the remains of the handiworks of the ancient inhabitants of Scotland, to enter into the spirit of that peculiar and interesting people, which has always attracted the attention and touched the hearts of men accessible to the influence of heroic poetry. The Spalding Club, founded in this city for the preservation of the historical and literary remains of the north-eastern counties of Scotland, is honourably known by its important publications.

Gentlemen, this is the 29th anniversary of the foundation of this Association; and well may we look back with satisfaction to its operation and achievements throughout the time of its existence. When, on the 27th September, 1831, the meeting of the Yorkshire Philosophical Society took place at York, in the theatre of the Yorkshire Museum, under the presidency of the late Earl Fitzwilliam, then Viscount Milton, and the Rev. W. Vernon Harcourt eloquently set forth the plan for the formation of a British Association for the promotion of science, which he showed to have become a want for his country, the most ardent supporter of this resolution could not have anticipated that it would start into life full-grown, as it were, enter at once upon its career of usefulness, and pursue it without deviation from the original design, triumphing over the oppositions which it had to encounter in common with everything that is new and claims to be useful. Gentlemen, this proved that the want was a real and not an imaginary one, and that the mode in which it was intended to supply that want was based upon a just appreciation of unalterable truths. Mr. Vernon Harcourt summed up the desiderata in graphic words, which have almost identically been retained as the exposition of the objects of the Society, printed at the head of the annually-appearing volume of its transactions:—"To give a stronger impulse and more systematic direction to scientific inquiry—to promote the intercourse of those who cultivate science in different parts of the empire, with one another and with foreign philosophers—and to obtain a more general attention to the objects of science, and a removal of any disadvantages of a public kind which impede its progress."

To define the nature of science, to give an exact and complete definition of what that science, to whose service the Association is devoted, is and means, has, as it naturally must, at all times occupied the metaphysician. He has answered the question in various ways, more or less satisfactorily to himself or others. To me, science, in its most general and comprehensive acceptation, means the knowledge of what I know, the consciousness of human knowledge. Hence, to know is the object of all science; and all special knowledge, if brought to our consciousness in its separate distinctiveness from, and yet in its recognised relation to the totality of our knowledge, is scientific knowledge. We require, then, for science—that is to say, for the acquisition of scientific knowledge—those two activities of our mind which are necessary for the acquisition of *any* knowledge—analysis and synthesis; the first, to dissect and reduce into its component parts the object to be investigated, and to render an accurate account to ourselves of the nature and qualities of these parts by observation; the second to recompose the observed and understood parts into a unity in our consciousness, exactly answering to the object of our investigation. The labours of the man of science are therefore at once the most humble and the loftiest which man can undertake. He only does what every little child does from its first awakening into life, and must do every moment of its existence; and yet he aims at the gradual approximation to divine truth itself. If, then, there exists no difference between the work of the man of science and that of the merest child, what constitutes the distinction? Merely the conscious self-determination. The child observes what accident brings before it, and unconsciously forms its notion of it; the so-called practical man observes what his special work forces upon him, and he forms his notions upon it with reference to this particular work. The man of science observes what he intends to observe, and knows why he intends it. The value which the peculiar object has in his eyes is not determined by accident, nor by an external cause, such as the mere connexion with work to be performed, but by the place which he knows this object to hold in the general universe of knowledge, by the relation which it bears to other parts of that general knowledge.

To *arrange* and *classify* that universe of knowledge becomes therefore the first, and perhaps the most important, object and duty of science. It is only when brought into a system, by separating the incongruous and combining those elements in which we have been enabled to discover the internal connexion which the Almighty has implanted in them, that we can hope to grapple with the boundlessness of his creation, and with the laws which govern both mind and matter.

The operation of science, then, has been systematically to divide human knowledge, and raise, as it were, the separate groups of subjects for scientific consideration into different and distinct sciences. The tendency to create new sciences is peculiarly apparent in our present age, and is perhaps inseparable from so rapid a progress as we have seen in our days; for the acquaintance with and mastering of distinct branches of knowledge enables the eye, from the newly-gained points of sight, to see the new ramifications into which they divide themselves in strict consecutiveness and with logical necessity. But in thus gaining new centres of light, from which to direct our researches, and new and powerful means of adding to its ever-increasing treasures, science approaches no nearer to the limits of its range, although travelling further and further from its original point of departure. For God's world is infinite; and the boundlessness of the universe, whose confines appear ever to retreat before our finite minds, strikes us no less with awe when, prying into the starry crowd of heaven, we find new worlds revealed to us by every increase in the power of the telescope, than when the microscope discloses to us in a drop of water, or an atom of dust, new worlds of life and animation, or the remains of such as have passed away.

Whilst the tendency to push systematic investigation in every direction enables the individual mind of man to bring all the power of which he is capable to bear on the specialities of his study, and enables a greater number of labourers to take part in the universal work, it may be feared that that consciousness of its unity which must pervade the whole of science if it is not to lose its last and highest point of sight, may suffer. It has occasionally been given to rare intellects and the highest genius to follow the various sciences in their divergent roads, and yet to preserve that point of sight from which alone their totality can be contemplated and directed. Yet how rare is the appearance of such gifted intellects! and if they be found at intervals, they remain still single individuals, with all the imperfections of human nature.

The only mode of supplying with any certainty this want, is to be sought in the combination of men of science representing all the specialities, and working together for the common object of preserving that unity and presiding over that general direction. This has been to some extent done in many countries by the establishment of academies embracing the whole range of the sciences, whether physical or metaphysical, historical or political. In the absence of such an institution in this country, all lovers of science must rejoice at the existence and activity of this Association, which embraces in its sphere of action, if not the whole range of the sciences, yet a very large and important section of them, those known as the *inductive sciences*, excluding all that are not approached by the inductive method of investigation. It has, for instance (and, considering its peculiar organization and mode of action, perhaps not unwisely), eliminated from its consideration and discussions those which come under the description of moral and political sciences. This has not been done from undervaluing their importance and denying their sacred right to the special attention of mankind, but from a desire to deal with those subjects only which can be reduced to positive proof, and do not rest on opinion or faith. The subjects of the moral and political sciences involve not only opinions but feelings; and their

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discussion frequently rouses passions. For feelings are "subjective," as the German metaphysician has it—they are inseparable from the individual being—an attack upon them is felt as one upon the person itself; whilst facts are "objective" and belong to everybody—they remain the same facts at all times and under all circumstances: they can be proved; they have to be proved, and when proved, are finally settled. It is with facts only that the Association deals. There may for a time exist differences of opinion on these also, but the process of removing them and resolving them into agreement is a different one from that in the moral and political sciences. These are generally approached by the deductive process: but if the reasoning be ever so acute and logically correct, and the point of departure, which may be arbitrarily selected, is disputed, no agreement is possible; whilst we proceed here by the *inductive* process, taking nothing on trust, nothing for granted, but reasoning upwards from the meanest fact established, and making every step sure before going one beyond it, like the engineer in his approaches to a fortress. We thus gain ultimately a roadway, a ladder by which even a child may, almost without knowing it, ascend to the summit of truth, and obtain that immensely wide and extensive view which is spread below the feet of the astonished beholder. This road has been shown us by the great Bacon; and who can contemplate the prospects which it opens, without almost falling into a trance similar to that in which he allowed his imagination to wander over future ages of discovery!

From amongst the political sciences it has been attempted in modern times to detach one which admits of being severed from individual political opinions, and of being reduced to abstract laws derived from well-authenticated facts. I mean political economy, based on general statistics. A new association has recently been formed, imitating our perambulating habits, and striving to comprehend in its investigations and discussions even a still more extended range of subjects, in what is called "Social Science." These efforts deserve our warmest approbation and good will. May they succeed in obtaining a purely and strictly scientific character! Our own Association has, since its meeting at Dublin, recognised the growing claims of political economy to scientific brotherhood, and admitted it into its statistical section. It could not have done so under abler guidance and happier auspices than the Presidency of the Archbishop of Dublin, Dr. Whately, whose efforts in this direction are so universally appreciated. But even in this section, and whilst statistics alone were treated in it, the Association as far back as 1833 made it a rule that, in order to ensure positive results, only those classes of facts should be admitted which were capable of being expressed by numbers, and which promised, when sufficiently multiplied, to indicate general laws.

If, then, the main object of science—and I beg to be understood, henceforth, as speaking only of that section which the Association has under its special care, viz., inductive science—if, I say, the object of science is the discovery of the laws which govern natural phenomena, the primary condition for its success is: accurate observation and collection of facts in such comprehensiveness and completeness as to furnish the philosopher with the necessary material from which to draw safe conclusions.

Science is not of yesterday. We stand on the shoulders of past ages, and the amount of observations made, and facts ascertained, has been transmitted to us and carefully preserved in the various storehouses of science; other crops have been reaped, but still lie scattered on the field; many a rich harvest is ripe for cutting, but waits for the reaper. Economy of labour is the essence of good husbandry; and no less so in the field of science. Our Association has felt the importance of this truth, and may well claim, as one of its principal merits, the constant endeavour to secure that economy.

One of the latest undertakings of the Association has been, in conjunction with the Royal Society, to attempt the compilation of a classified catalogue of scientific memoirs, which, by combining under one head the titles of all memoirs written on a certain subject, will, when completed, enable the student who wishes to gain information on that subject to do so with the greatest ease. It gives him, as it were, the plan of the house, and the key to the different apartments in which the treasures relating to his subject are stored, saving him at once a painful and laborious search, and affording him at the same time an assurance that what is here offered contains the whole of the treasures yet acquired.

While this has been one of its latest attempts, the Association has from its very beginning kept in view that its main sphere of usefulness lay in that concentrated attention to all scientific operations which a general gives to the movements of his army, watching and regulating the progress of his impetuous soldiers in the different directions to which their ardour may have led them, carefully noting the gaps which may arise from their independent and eccentric action, and attentively observing what impediments may have stopped, or may threaten to stop, the progress of certain columns.

Thus it attempts to fix and record the position and progress of the different labours, by its reports on the state of sciences published annually in its transactions; thus it directs the attention of the labourers to those gaps which require to be filled up, if the progress is to be a safe and steady one; thus it comes forward with a helping hand in striving to remove those impediments which the unaided efforts of the individual labourer have been or may be unable to overcome.

Let us follow the activity of the Association in these three different directions.

The reports on the state of science originate in the conviction of the necessity for fixing at given intervals, with accuracy and completeness, the position at which it has arrived. For this object the General Committee of the Association entrusts to distinguished individuals in the different branches of science the charge of becoming, as it were, the biographers of the period. There are special points in different sciences in which it sometimes appears desirable to the different sections to have special reports elaborated; in such cases the General Committee, in its capacity of the representative assembly of all the sciences, reserves to itself the right of judging what may be of sufficient importance to be thus recorded.

The special subjects which the Association points out for investigation, in order to supply the gaps which it may have observed, are—either such as the philosopher alone can successfully investigate, because they require the close attention of a practised observer, and a thorough knowledge of the particular subject; or they are such as require the greatest possible number of facts to be obtained. Here science often stands in need of the assistance of the general public, and gratefully accepts any contributions offered, provided the facts be accurately observed. In either case the Association points out *what* is to be observed and *how* it is to be observed.

The first is the result of the same careful sifting process which the Association employs in directing the issue of special reports. The investigations are entrusted to specially-appointed committees or selected individuals. They are in most cases not unattended with considerable expense, and the Association, not content with merely suggesting and directing, furnishes by special grants the pecuniary means for defraying the outlay caused by the nature and extent of the inquiry. If we consider that the income of the Association is solely derived from the contributions of its members, the fact that no less a sum than £17,000 has, since its commencement, been thus granted for scientific purposes, is certainly most gratifying.

The question *how* to observe resolves itself into two—that of the scientific method which is to be employed in approaching a problem or in making an observation, and that of the philosophical instruments used in the observation or experiment. The Association brings to bear the combined knowledge and experience of the scientific men, not only of this but of other countries, on the discovery of that method which, while it economises time and labour, promises the most accurate results. The method to which, after careful examination, the palm has been awarded, is then placed at the free disposal and use of all scientific investigators. The Association also issues, where practicable, printed forms, merely requiring the different heads to be filled up, which, by their uniformity, become an important means for assisting the subsequent reduction of the observations for the abstraction of the laws which they may indicate.

At the same time most searching tests and inquiries are constantly carried on in the Observatory at Kew, given to the Association by Her Majesty, the object of which is practically to test the relative value of different methods and instruments, and to guide the constantly progressive improvements in the construction of the latter.

The establishment at Kew has undertaken the further important service of verifying and correcting to a fixed standard the instruments of any maker, to enable observations made with them to be reduced to the same numerical expression. I need hardly remind the inhabitants of Aberdeen that the Association, in one of the first years of its existence, undertook the comparative measurement of the Aberdeen standard scale with that of Greenwich—a research ably carried out by the late Mr. Baily.

The impediments to the general progress of science, the removal of which I have indicated as one of the tasks which the Association has set for itself, are of various kinds. If they were only such as direction, advice, and encouragement would enable the individual, or even combined efforts of philosophers, to overcome, the exertions of the Association which I have just alluded to might be sufficient for the purpose. But they are often such as can only be successfully dealt with by the powerful arm of the State or the long purse of the nation. These impediments may be caused either by the social condition of the country itself, by restrictions arising out of peculiar laws, by the political separation of different countries, or by the magnitude of the undertakings being out of all proportion to the means and power of single individuals, of the Association, or even the voluntary efforts of the public. In these cases the Association, together with its sister society, "The Royal Society," becomes the spokesman of science with the Crown, the Government, or Parliament—sometimes even through the Home Government with foreign Governments. Thus it obtained the establishment, by the British Government, of magnetic and meteorological observatories in six different parts of the globe, as the beginning of a network of stations which we must hope will be so far extended as to compass by their geographical distribution the whole of the phenomena which throw light on this important point in our tellurian and even cosmical existence. The Institute of France, at the recommendation of M. Arago, whose loss the scientific world must long deplore, cheerfully co-operated with our council on this occasion. It was our Association which, in conjunction with the Royal Society, suggested the Antarctic expedition with a view to further the discovery of the laws of terrestrial magnetism, and thus led to the discovery of the southern polar continent. It urged on the Admiralty the prosecution of the tidal observations, which that department has since fully carried out. It recommended the establishment, in the British Museum, of the conchological collection exhibiting present and extinct species, which has now become an object of the greatest interest.

I will not weary you by further examples, with which most of you are better acquainted than I am myself, but merely express my satisfaction

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that there should exist bodies of men who will bring the well-considered and understood wants of science before the public and the Government, who will even hand round the begging-box and expose themselves to refusals and rebuffs to which all beggars are liable, with the certainty, besides, of being considered great bores. Please to recollect that this species of bore is a most useful animal, well adapted for the ends for which nature intended him. He alone, by constantly returning to the charge and repeating the same truths and the same requests, succeeds in awakening attention to the cause which he advocates, and obtains that hearing which is granted him at last for self-protection, as the minor evil compared to his importunity, but which is requisite to make his cause understood. This is more particularly the case in a free, active, enterprising, and self-determining people like ours, where every interest works for itself, considers itself the all-important one, and makes its way in the world by its own efforts. Is it, then, to be wondered at that the interests of science, abstract as science appears, and not immediately showing a return in pounds, shillings, and pence, should be postponed, at least, to others which promise immediate tangible results? Is it to be wondered at that even our public men require an effort to wean themselves from other subjects in order to give their attention to science and men of science, when it is remembered that science, with the exception of mathematics, was until of late almost systematically excluded from our school and university education—that the traditions of early life are those which make and leave the strongest impression on the human mind, and that the subjects with which we become acquainted, and to which our energies are devoted in youth, are those for which we retain the liveliest interest in after years, and that for these reasons the effort required must be both a mental and a moral one? A deep debt of gratitude is therefore due to bodies like this Association, which not only urges the wants of science on the Government, but furnishes it at once with well-matured plans how to supply them with the greatest certainty and to the greatest public advantage.

We may be justified in hoping, however, that by the gradual diffusion of science, and its increasing recognition as a principal part of our national education, the public in general, no less than the Legislature and the State, will more and more recognise the claims of science to their attention; so that it may no longer require the begging-box, but speak to the State, like a favoured child to its parent, sure of his parental solicitude for its welfare; that the State will recognise in science one of its elements of strength and prosperity, to foster which the clearest dictates of self-interest demand.

If the activity of this Association, such as I have endeavoured to describe it, ever found or could find its personification in one individual—its incarnation, as it were—this had been found in that distinguished and revered philosopher who has been removed from amongst us in his ninetieth year, within these last few months. Alexander von Humboldt incessantly strove after dominion over that universality of human knowledge which stands in need of thoughtful government and direction to preserve its integrity; he strove to tie up the *fasces* of scientific knowledge, to give them strength in unity. He treated all scientific men as members of one family, enthusiastically directing, fostering, and encouraging inquiry, where he saw either the want of or the willingness for it. His protection of the young and ardent student led many to success in their pursuit. His personal influence with the Courts and Governments of most countries in Europe enabled him to plead the cause of science in a manner which made it more difficult for them to refuse than to grant what he requested. All lovers of science deeply mourn for the loss of such a man. Gentlemen, it is a singular coincidence, that this very day on which we are here assembled, and are thus giving expression to our admiration of him, should be the anniversary of his birth.

To return to ourselves, however: one part of the functions of the Association can receive no personal representation, no incarnation; I mean the very fact of meetings like that which we are at present inaugurating. This is not the thoughtful direction of one mind over acquired knowledge, but the production of new thought by the contact of many minds, as the spark is produced by the friction of flint and steel; it is not the action of the monarchy of a paternal Government, but the republican activity of the Roman Forum. These meetings draw forth the philosopher from the hidden recesses of his study, call in the wanderer over the field of science to meet his brethren, to lay before them the results of his labours, to set forth the deductions at which he has arrived, to ask for their examination, to maintain in the combat of debate the truth of his positions and the accuracy of his observations. These meetings, unlike those of any other society, throw open the arena to the cultivators of all sciences, to their mutual advantage; the geologist learns from the chemist that there are problems for which he had no clue, but which that science can solve for him; the geographer receives light from the naturalist, the astronomer from the physicist and engineer, and so on. And all find a field upon which to meet the public at large, invite them to listen to their reports, and even to take part in their discussions—show to them that philosophers are not vain theorists, but essentially men of practice—not conceited pedants, wrapped up in their own mysterious importance, but humble inquirers after truth, proud only of what they may have achieved or won for the general use of man. Neither are they daring and presumptuous unbelievers—a character which ignorance has sometimes affixed to them—who would, like the Titans, storm heaven by placing mountain upon mountain, till hurled down from the height attained by the terrible thunders of outraged Jove; but rather the pious pilgrims to the Holy Land, who toil on in search of the sacred shrine, in search of truth—God's truth—God's laws as manifested in His works, in His creation.

THE LATE MR. BRUNEL, C.E.

BY this time the death of Mr. I. K. Brunel, who first started the idea of the Great Eastern, has become known to all of our readers. We abridge the following interesting memoir of the lamented gentleman from the *Illustrated News of the World* of the 25th of March last, (adapting the tense of the article to present circumstances), and we may also inform our readers that with that number of the paper an admirably life-like portrait of Mr. Brunel may be obtained:—

Isambard Kingdom Brunel, Esq., was one of those individuals who have inherited a professional name and professional talents, like the Stephensons and the Herschels, both of whom have been equally distinguished in a second generation for the engineering skill and astronomical science which belonged to their fathers respectively. He was the only son of the late Sir Mark Isambard Brunel, the engineer of the Thames Tunnel, by Miss Sophie Kingdom, of Rouen. He was born in 1806 at Portsmouth, where his father was engaged in erecting the block machinery for the Government Dockyard. Whilst still a child he was sent for his education to France, of which country his father was a native, and studied mathematics and civil engineering at the College, Henri Quatre, at Caen, until the completion of the usual course. He was about twenty years of age when he commenced the work of a practical engineer under his father, who was engaged in the excavation of the Thames Tunnel. It is well known that the progress of that gigantic and amazing work was frequently interrupted by the influx of water from the bed of the river above, and that one or two fatal accidents occurred to the workmen engaged upon it. But it may not be equally well known that Mr. Brunel, on these occasions, was always the last to quit his post, and only saved his life by swimming—an art in which he was particularly expert. In 1828 the final irruption, as we learn from an article in the "English Cyclopædia," surprised him when he was some six hundred feet distant from the end of the tunnel; he was, however, borne along by the stream, and, not losing his usual composure and presence of mind, he happily rose to the surface near the top of one of the shafts, and so contrived to save his valuable life. The special objects of Mr. Brunel's study were mechanical and railway engineering, and the construction of machinery for locomotives and steam navigation, though he devoted no less than ten years to the experiments made by his illustrious father to test the applicability of carbonic acid gas as a motive power to engines of various kinds. Already, namely in 1830, Mr. Brunel had been elected a Fellow of the Royal Society, mainly on the score of the professional reputation which he had gained in the elaboration of the Thames Tunnel. In 1833 he was appointed chief engineer to the Great Western Railway, then first projected, the whole of which line, including the arches, viaducts, and tunnels, was constructed from his designs or under his direction. Among the most important works in the way of bridges on this line of railway, as well as on its extension branches, may be mentioned the bridge over the Thames at Maidenhead, remarkable for the longest and flattest arches made of brick; and that over the Wye at Chepstow for the great difficulties overcome in its construction; and that over the river Tamar at Devonport, which in span and height is of nearly the same dimensions as the Britannia Bridge over the Menai Straits. In the celebrated "battle of the gauges" he supported the claims of the "broad gauge," but unsuccessfully, against Mr. Stephenson. Mr. Brunel was also largely engaged as a civil engineer upon the construction, remodelling, extension, and improvement of very many of the docks at our largest outports. The most important of these are the Bute Docks at Cardiff and the old North Dock at Sunderland. Mr. Brunel was the engineer and designer of the Great Western steam ship, and also of the Great Britain, and several others of our largest steamers. In 1842 he was employed by her Majesty's Government to construct the elegant Suspension Bridge which spans the River Thames at Hungerford, which has the widest span of any bridge in England. He also took an active part in assisting Mr. Stephenson to float and to raise into their present position the Conway and the Britannia tubular bridges on the line between Liverpool and Holyhead. In 1850 Mr. Brunel had entrusted to his care the works of the Tuscan portion of the Sardinian railway, which he conducted to a successful termination in about three years. During the recent war with Russia Mr. Brunel's talents as a civil engineer were again called into requisition for the establishment and refitting of the Renikoi hospitals on the strait of the Dardanelles. After his return from this task in the East, Mr. Brunel's energies were mainly devoted to the construction of the Great Eastern, which he originally projected jointly with Mr. J. Scott Russell. Mr. Brunel was chosen a member of the Council of the Royal Society in 1844. He was also one of the Vice-Presidents of the Institution of Civil Engineers and of the Society of Arts, a Fellow of the Astronomical, Geological, and Geographical Societies, and a Chevalier of the Legion of Honour.

PATENT MILL-BANDING.—It would seem that we last week were led into an error, in reply to numerous readers, in stating that Messrs. Spills' Patent Mill Banding could be obtained at Bread-street, City. The Government contract works at Stepney Green is the only place, for the present, where it should be applied for, and where the strongest tests of its utility may be witnessed in its practical application to machinery under extraordinary difficulties, purposely designed for such exposition. The retail house in Bread-street has been closed.

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SIR WILLIAM ARMSTRONG'S NEW MUZZLE-LOADING ORDNANCE.

SIR WILLIAM ARMSTRONG recently obtained protection under the Patent Law for an improvement in muzzle-loading ordnance and projectiles, which he thus describes :—

"In rifled ordnance as heretofore made (other than breech-loading ordnance) the loading, owing to the necessary tightness of the fit, presents serious practical difficulties, which it is the object of this invention to avoid. For this purpose I cause the projectile, fitted with suitable fillets or projections on one side, to enter the piece of ordnance by one and to leave it by another track, the projectile and the piece of ordnance being so adapted to each other as that the projectile on entering and throughout the loading of the piece of ordnance shall be free and easy to move, but on leaving the piece of ordnance shall be sufficiently tight to preserve the steadiness essential to precision of action. The projectile, in addition to the ordinary projections on projectiles adapted for rifled ordnance, is furnished with certain piece or pieces of a soft material, which will crush and prevent any jamming or too great tightness as the projectile leaves the piece of ordnance." Sir William has not proceeded to complete his patent for this invention.

IMPROVED METALLIC SHIPS.

MR. J. SCOTT RUSSELL, the builder of the Great Eastern, has just obtained letters patent for a novel kind of metallic ships, designed apparently to obviate the fouling to which the bottoms of iron vessels are subject. His invention consists in constructing the framing of the ship of angle and other bars, made of yellow or Muntz's metal; and in plating the framing with sheets of a like metal; and also in plating the frames of ships constructed of angle-iron, or other bars of iron, with sheets of yellow or Muntz's metal. The sheets of such yellow or Muntz's metal are to be fastened to each other and to the framing by rivets of the same metal. The cutwaters also, and the stern and rudder posts, and other parts of the framing of ships and vessels, as well as the rudders, are to be by preference of Muntz's or yellow metal. For these purposes it is believed that the best compound or alloy consists of about 60 parts of the best copper, and 40 parts of the best spelter; but such proportions may be varied, as is well known, within moderate limits. "It is preferred," says Mr. Russell, "to construct the frame of a ship or vessel of the yellow metal, and to combine therewith sheets of like metal; but I have by experiment ascertained that the particular alloy of copper and zinc above mentioned is so near iron in its electrical character as not to act largely thereon when the two are placed in contact in sea water, and therefore that in constructing a ship or vessel, a frame of iron may advantageously be plated over with sheets of yellow or Muntz's metal, whilst sheets of copper are wholly unsuited for the purpose." Mr. Russell, in his specification of the invention, further says :— "The frame of a vessel when of yellow or Muntz's metal, I construct of any convenient form, as when iron is employed, and employ a similar section of metal both in form and size. The yellow or Muntz's metal is brought to the section required by rolling, just as is the case with iron, and it is worked in a similar manner. The stern posts and other parts, which in iron ships are forged, I prefer when yellow or Muntz's metal is used to cast to form. The plating of yellow or Muntz's metal I make of the same thickness as when iron is used, and it is secured to the frame by rivets of yellow or Muntz's metal, which are worked in a similar manner to iron rivets, but care should be taken not to heat the rivets too highly, and not to keep them heated longer than is necessary. When an iron frame is to be plated with yellow or Muntz's metal, it is to be constructed as if an iron plating were to be employed, and the yellow or Muntz's metal plates should be of a thickness such as is usual for plating ships with iron. Either yellow or Muntz's metal or iron rivets may be used, but yellow or Muntz's metal is preferred." It is difficult to see at once the probable bearing of such an invention as this. It would seem, however, that it must either be a very valuable or a very worthless one, and from the known ability of the patentee, it can scarcely be deemed the latter.

THE SAFETY MATCH.

IT will be seen by referring to the statistics of London fires during the year 1858, as given in our impression of the 4th of March last, that out of the 1,114 fires forming the total of serious conflagrations, the following proportion was occasioned by the usual contrivances for procuring flame, viz. :—

Children playing with lucifers... ...	12
Lucifer matches accidentally ignited	7
" " making	3
" " careless use of ...	17
	39

In the first of these instances the sacrifice of life and wholesale destruction of property were traced principally to the fact of children inserting lucifer matches into various nooks and crevices where an accidental concussion had produced their ignition. The next in the series of casualties are accidents resulting from the sudden ignition of boxes or bundles of phosphorised matches. The necessity as well as the possibility of removing the fatal cause of these accidents has long been felt; and we are happy to introduce to the notice of our readers a contrivance by which such occurrences, which hitherto have led to so many terrible disasters, may now be completely obviated. This invention, which has reached us from across the Channel, and which has already been adopted in most of the large establishments in Paris and other towns of France, consists of a match which cannot ignite by friction with ordinary substances, but which bursts into flame when struck upon a chemically-prepared substance, owing to the peculiar action occurring between the two bodies which are thus brought into contact. Without the prepared strip, the matches may be struck or trodden upon without the possibility of ignition. The advantage of having these articles tipped with a material which is not inflammable *per se* is sufficiently obvious, and we doubt not will recommend the "Safety Match" not only to careful housewives, but to the owners of large establishments where the ordinary "lucifers" are now used, and, we are afraid, often left carelessly about. The cost of the "Safety Match" is scarcely more than that of its less trustworthy predecessor. It is to be had of Mr. Twinberrow, chemist, 2 Edward's-street, Portman-square, who is the sole agent in this country for the article.

NEW PHOTOGRAPHIC PROCESS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Perhaps you will be kind enough to call the attention of the photographic public to the following discovery.

If some perchloride of iron be poured over a piece of polished copper (such as used by engravers) the copper will immediately be affected, and its colour slightly changed. The plate may now be washed with water, and dried with a cloth, when it is sensitive to the light of sunshine. If a negative picture be placed upon it in the ordinary way, and it be then exposed to *sunshine*, in ten minutes or a quarter of an hour a beautiful black positive on a copper ground will be obtained. Silver may be used, but not so well.

This experiment establishes the fact of the two substances, copper and perchloride of iron, acting photographically; the facility, too, of obtaining a picture to be engraved so easily and directly upon the copper-plate, will doubtless prove useful to engravers. I remain, Gentlemen,

Your obedient servant,

COLLIN SMART.

Sunderland, 19th September, 1859.

ALLISON'S IMPROVED BORING AND SINKING TOOLS.

MR. RICHARD ALLISON, of Birmingham, engineer, has just completed a patent for improvements in apparatuses for boring and sinking, which he describes as follows :—

My boring head or tool is hollow, and of wrought or cast-iron, furnished at bottom with a series of chisels or cutters inside the tool, and near the end where the cutters are fixed is a valve of india-rubber, gutta-percha, or other like material, the edges of which rest upon a ledge fixed on the inside of the tool. I fit a door or trap to the side of the tool, the bottom of which is in a line with the valve seat. The top of the tube carries an ordinary bow sling, whereby to connect it to the rope or chain for communicating the necessary motion to the tool. Wooden blocks are fitted to the outside of the tool, to act as fenders, and prevent injury from the sides of the well or shaft. For the purpose of raising and emptying the débris from a well or shaft in the course of being sunk, I employ a pump or vessel consisting of two cylinders one over the other, and the upper cylinder capable of sliding inside that under it; the bottom cylinder is provided with a valve opening inwards, and over the top of the upper cylinder there is a similar valve. The cylinders are held in a suitable frame, and are connected to a rope or chain. Upon the pump being lowered, the upper cylinder will fall within the lower, then upon this upper cylinder being raised a partial vacuum will be formed, wherefore the débris, slush, &c., will flow into the lower cylinder, and be there retained by the bottom valve falling back upon its seat, and closing egress from the bottom of the cylinder. A joint in the frame permits of the lower cylinder being tilted in order to empty its contents. My last apparatus consists of a hollow vessel of lead, gutta-percha, or other suitable material, furnished with valves connected to a valve rod. This vessel is intended to contain muriatic or other acid for burning out or removing chalk, or other matter, in a shaft or well. Upon the vessel being lowered, charged, to the spot where the acid is to operate, the valve rod is raised to let out the contents of the vessel.

Fig. 1 of the engravings (on next page) is a vertical section of a boring head or tool, constructed according to this invention. *A* is a hollow cylinder formed of wrought or cast-iron, to the lower part or bottom of which a series of chisels or cutters *B B* are bolted or otherwise attached; *C* is a valve formed of india-rubber or other material, held by a spindle *D*, which slides through a frame *E*. A door or trap (not shown in the drawing) is fitted near the bottom of the cylinder for the purpose of clearing out all dirt; *G G* are fenders, which I prefer to form of wood, fixed to the side of the cylinder by screws. *H* is a bow-sling, to which a rope or chain is connected for imparting the necessary motion to the tool.

Fig. 2 is a sectional elevation of a pump or apparatus employed for the purpose of raising and emptying the débris from a well or shaft in the course of being sunk. *A B* are two cylinders, which are so constructed that the cylinder *A* shall be free to slide within the cylinder *B*. The lower cylinder *B* is provided with a valve *C*, opening inwards, and carried by a spindle *D*, working through a frame *E*, resting on a ledge formed on the lower part of the cylinder *B*. A similar valve, *F*, to that just mentioned is fitted to the upper part of the cylinder *A*. *G* is a rod attached to the cylinder *A*, and working through a frame or guide *H*, which is jointed or hinged at *I I*, and connected to the lower cylinder *B* at *J J* by bolts and rivets, as shown. *G'* is a stop or washer formed on or fitted to the rod *G*, to regulate the height to which the cylinder *A* is drawn; *K* is a bow-sling fitted to the end of the rod *G*, to which a rope or chain is attached for working the apparatus.

To remove slush or débris from a shaft or well the apparatus is lowered to the bottom, and the upper cylinder will fall within the lower; the upper cylinder *A* is then raised by the rope,

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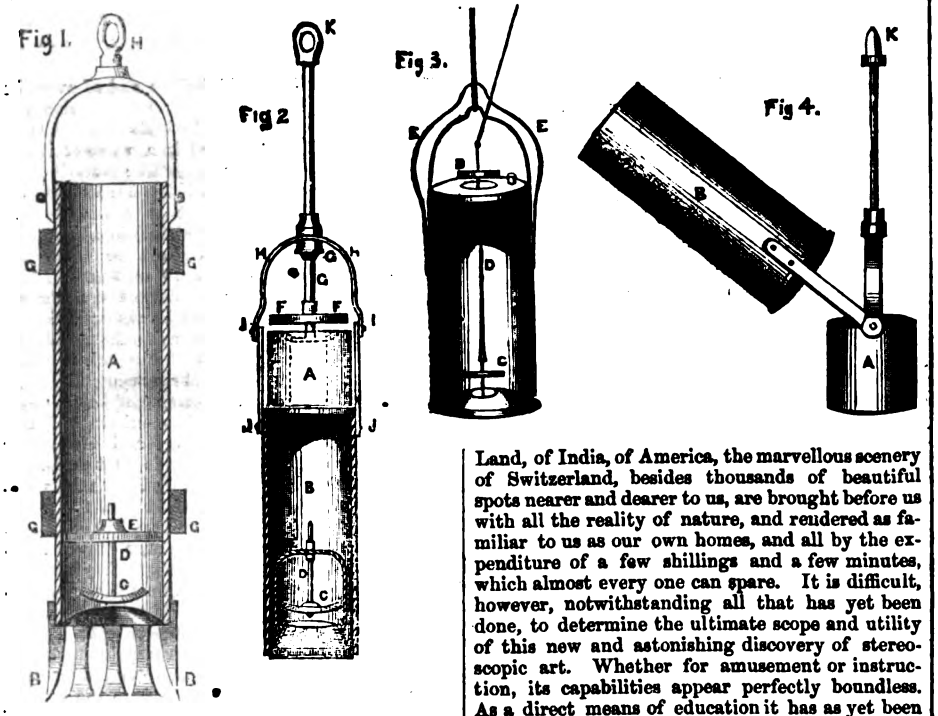
ALLISON'S IMPROVED BORING AND SINKING TOOLS.

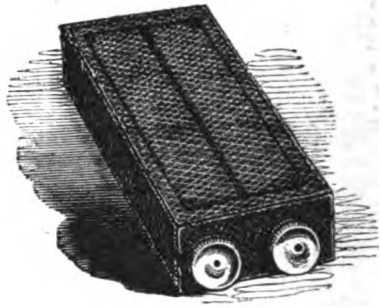


whereupon slush, débris, &c., will be drawn into the lower cylinder *B*. As soon as the upper cylinder *A* is raised to the top of the cylinder *B*, the weight of stuff in it forces down the valve *C*, and the apparatus is drawn up to be emptied. The emptying is effected by drawing the upper cylinder out of the lower, and turning it clear of the mouth thereof as shown at Fig. 4, when the contents of the lower cylinder are poured out.

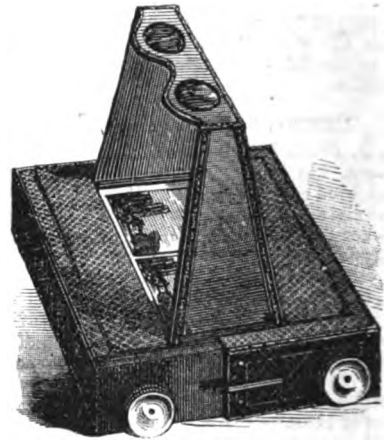
Fig. 3 is a sectional elevation of an apparatus employed in connection with the invention for burning out or removing chalk or other matter from a shaft or well. *A* is a hollow vessel formed of lead, gutta-percha, or other suitable material; *B C* are valves connected to a rod *D*, the upper part of which is formed with an eye to connect a rope to; *E* is a sling for attaching a rope to lower the vessel. The vessel *A* is filled with muriatic or other acid, and lowered to the bottom of a well or shaft, when there the rod *D* is raised, which opens the valves *B C*, and allows the acid to flow out.

THE POCKET STEREOSCOPIC PANORAMA.

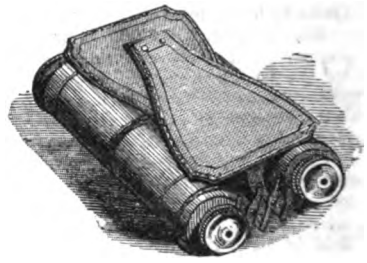
IT is surely quite time that something new made its appearance in apparatus for the exhibition of stereoscopic views, now that the taking of such views occupies hundreds, or we may say thousands, of artists, both amateur and professional, in all parts of the world. Not a town or village, river or brook, hill or valley, mountain or plain, escapes the earnest attention of these lovers of nature. Nor is it only with natural objects that our stereoscopic artists busy themselves; they dive into crypts, vaults, and chancels, and attain what appear to be inaccessible heights, to copy the works of men's hands also. No flights of steps are too bold or too long for them to ascend, no galleries too dark for them to penetrate, no steeples or towers too high for them to reach, if not by steps, yet by ladders and ropes, even, as it were, to outvie each other in overcoming the difficulties of their calling, in order to enable us to enjoy whatever is beautiful in form, curious in workmanship, or interesting from historical associations. By the stereoscopic artist's efforts we are taken in the course of a few minutes from one end of the globe to the other, having learned the history and felt the presence of many objects worthy of study. The wonders of Egypt and of the Holy Land, of India, of America, the marvellous scenery of Switzerland, besides thousands of beautiful spots nearer and dearer to us, are brought before us with all the reality of nature, and rendered as familiar to us as our own homes, and all by the expenditure of a few shillings and a few minutes, which almost every one can spare. It is difficult, however, notwithstanding all that has yet been done, to determine the ultimate scope and utility of this new and astonishing discovery of stereoscopic art. Whether for amusement or instruction, its capabilities appear perfectly boundless. As a direct means of education it has as yet been comparatively little used, although peculiarly suited for such a purpose. There is scarcely a branch of scientific instruction which it could not be made effectually to illustrate and promote, rendering what would otherwise be most expensive, and beyond the reach of all but a very few, quite easy of possession—namely, correct illustrations of the objects studied. Natural history, in its largest sense, sculpture, architecture, history, physical geography, the manners and customs of nations, antiquities, and indeed every inquiry in which the forms of bodies or their disposition are concerned, may be illustrated in a manner in no way surpassable by means of stereoscopic pictures. What we seem to require is, that artists should set themselves to work to complete judicious series of views in each of the above-named or other departments of study; and, this done, we have in the apparatus we shall presently describe, all that is necessary in order to render stereoscopic views amazingly popular as ordinary means of education. The apparatus we refer to, and of which we append illustrations, is intended to facilitate this work by affording the means of grouping together in the most convenient form stereoscopic views relating to any special subject, instead of mounting them in the ordinary and disconnected way in which they have been hitherto presented to us. The apparatus is of the most simple kind, and in every respect most complete, occupying very little space, so as to be easily carried in the pocket, although containing, if required, as many as a hundred views, or even more, besides the stereoscope itself. Its manipulation is also of the simplest kind, and consists in turning the thumb-screw placed on one side of the case, by which movement the views are successively brought under the eye-glasses. When the apparatus is not in use, not only the stereoscope but the case containing it, as well as the views, collapse and shut up into the form shown in the smaller illustration of what is termed the "box" form. The other wood-cuts represent a modified arrangement of cylinder cases united together by a very ingenious system of bars or lazy-tongs, which expand or collapse as required, placing the cylinders either close together or far apart, so as to exhibit a view between them. The stereoscopic pictures are printed upon the thin French or German paper, and mounted upon silk manufactured for the purpose, which enables them to be wound upon mall rollers, which by suitabl means are slightly retarded in their motion, so as to strain the silk band and render the views perfectly flat when under view. This strain upon the silk band necessitates some contrivance, also, for keeping the rollers at a suitable distance when being examined, and this is very ingeniously



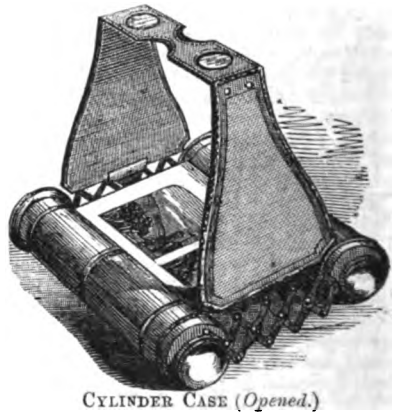
BOX CASE (*Closed*).



BOX CASE (*Opened*).



CYLINDER CASE (*Closed*).



CYLINDER CASE (*Opened.*)

managed by making the sides of the stereoscope fill up, so to speak, the opening between the two halves of the box casing, or the two cylinders of the modified arrangement. In this latter case the sides of the stereoscope are hinged to the system of bars or lazy-tongs connecting the cylinders, but instead of the sides being hinged

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at their lowest parts or edges, the hinges are attached about half or three-quarters of an inch from this point, so that this small portion of the sides *descends*, while the main part of the stereoscope is raised up, such descending portions locking in between the two cylinders, and so resisting any attempt to bring them together until the stereoscope is lowered for the purpose of shutting up the apparatus. The cases are, we understand, now being manufactured in large quantities both in fancy leathers and woods, papier mâché, metal, vulcanite, glass, and other materials, and we doubt not will take well with the public. The invention is that of Mr. E. E. Allen, of Parkside, Knightsbridge; the dies for the bars of the lazy-tongs having been made by Mr. Hobbs, at his well-known lock factory in Islington. The rivets for uniting them have also been manufactured by him, and the bars stamped out by means of the excellent machines employed in the manufacture of locks, of which some day we hope to find time to give our readers an account. In carrying out this invention Mr. Allen has called to his aid the leather-workers and glass manufacturers of London, the papier mâché makers and brass drawers of Birmingham, the lense grinders and spring makers of Sheffield, the silk and paper manufacturers of France, the vulcanite manufacturers of America, besides the kindly assistance of Mr. Hobbs, who undertook the stamping and rivet making part of the work from the interest he felt in the success of the invention, and knowing the great difficulty of getting anything new satisfactorily manufactured. To Messrs. Jennens and Bettridge also Mr. Allen expresses himself much indebted for their kind co-operation in the manufacture of papier mâché work.

THE ABRIDGED SPECIFICATIONS OF PATENTS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—In your abridged specifications of patents you state that the invention of W. and W. McNaught, No. 98, 1859, is not described apart from the drawings. I think it is a mistake, for there was a specification sent along with the drawings containing description and claim.

I remain, yours respectfully,

W. T. C.

P.S. I enclose my card.

Rochdale, September 15th, 1859.

[What is meant by saying that inventions are not described apart from the drawings, is merely that no verbal description, except that in which reference is made to the drawings, is given.—EDS. *M. M.*]

VERTICAL FIRE WITH ARROWS OR BOLTS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

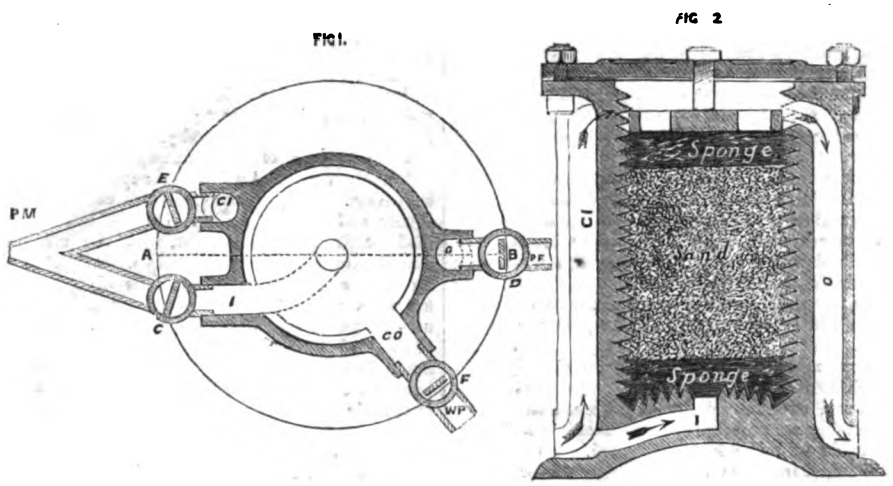
GENTLEMEN,—The employment of arrows for vertical fire, as put in practice by the Chinese in the defence of their forts during the late disastrous attack by our sea and land forces at the mouth of the Peiho river, will excite some discussion on the merits of such vertical fire; and as the flight of an arrow shot from a Chinese bow does not exceed two hundred yards, I beg to state that I was in the habit of shooting a bolt from a horse-pistol of the "Brown Bess" bore by vertical fire at Cork, about seven years ago, to the distance of more than four hundred yards. The weight of the bolt was, with its iron head, between three and four ounces. The cartridge was attached to the inner end of the bolt, and did not require to be opened previous to insertion. The head of the bolt projected an inch or two from the muzzle of the pistol, and its shaft being the full length of the barrel caused it to form its own ramrod. I made the above experiments to prove that the guard of a railway train could, from the rear of the train, throw a whistling or explosive bolt high over the head of the driver of the engine, and thus give him warning when required.

I am, Gentlemen, yours, &c.,

J. NORTON.

Rosherville, 19th Sept., 1859.

THE GLOUCESTER CORPORATION DRINKING FOUNTAIN FILTER.



THE GLOUCESTER CORPORATION DRINKING FOUNTAIN.

WE are indebted for the following letter to the Secretary of the Metropolitan Free Drinking Association. The description of the apparatus devised by the writer for Gloucester, may be of use in other towns:—

SIR,—Having been instructed by our corporation to prepare a design for free drinking fountains for this city, with the desire of escaping from the stereotyped absurdities of pure water vomited from lions' heads, &c., I had a figure modelled by Mr. Irish, a resident sculptor, representing a child playing at a well—a photograph of which, together with a photograph of the original sketch, showing recess, &c., I enclose. The design is now being carried out in cast-iron (bronzed), and the whole cost, including the fixing in wall, and laying on the water from the main, has been tendered for at £8 8s. each.

I have also purchased a filter, drawing of which I enclose, to act under pressure, a specimen casting of which I have been for the last week experimenting upon, and find it to act (delivering half-a-pint in ten seconds) admirably. You will notice the reverse action, from the top downwards, for cleansing. Each inlet and outlet has a tap on, and by means of the tap in the principal inlet the pressure and the quantity to be delivered may be easily regulated. You will notice, also, that this filter may be placed beneath the flags under the fountain, and covered by a small casing similar to that of the stop-cock casings on water services. By closing the stop-cock on the lower or main inlet, and opening the cleansing cock, the rising tube to the fountain may be emptied in times of severe frost. The cost of the filter, including fixing, &c., will not exceed 50s. The whole cost, therefore, of the fountain and filter, exclusive of drain to the sewers, will not under ordinary circumstances exceed eleven pounds.

Your obedient servant,

JOHN HARVEY,

City Surveyor and Chamberlain, Gloucester.

E. T. Wakefield, Esq., Hon. Sec. Free Drinking Fountain Association.

Gloucester, May 24th, 1859.

Reference to Engravings of Filter.

Figure 1 is a plan, and figure 2 a section through *A B* of figure 1. The taps at *C* and *D* are turned on for the ordinary action of the filter; and the pressure (and therefore the stream of the fountain) is regulated by the tap *C*. *P M* is the pipe from the main; *I* is the inlet; *O* is the outlet; *C I* is the cleansing inlet; *C O* the cleansing outlet; *P F* is the pipe leading to the fountain; *W P* is the waste pipe. The teeth or rings shown in Fig. 2 are intended to hold the sponge and sand between them, so as to prevent the water from passing *around* the sponge and sand. The plate at the top is pressed down by a screw, to keep the sponge and sand properly compressed.

THE CARBON GAS FIRE.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Several patents have been taken out "for gas fires in open grates," the patent being for the *material* used, such as "pumice," "asbestos," the material called the "polytechnic fire," "lump asbestos," and other material, the use of which is very limited in consequence of the expense. The "lump asbestos" is valued at a guinea a pound, and the "polytechnic fire" material, although not so expensive in itself, requires more gas to get up a red heat; it also becomes very brittle by use, so that when taken out of the grate to clean the gas-pipes, the holes requiring broaching occasionally, it breaks in pieces, destroying the effect intended. Finding this to be the case, and yet anxious to introduce gas-fires, I have been trying experiments with material of various kinds, and have succeeded in producing a gas-fire superior, I believe, to any yet introduced. I have taken out no patent for it, that all gas companies whose interest it is to introduce gas-fires to the public may do so at the cheapest possible rate. The material I find best suited for use is the carbon—removed by the process called scurfing—from gas-retorts; it should be broken up in lumps of about 2½ or 3 inches, and piled in the grate by hand, not thrown on in a mass. I find this material absorbs the gas, and causes a perfect combustion, making an excellent fire, and throwing out a great heat, with a less consumption of gas than any other material. Gas companies can sell the carbon at 2s. 6d. per bushel ready broken, so that the cost of the material will be trifling, one bushel lasting from three to six months, according to the heat required.

I am, Gentlemen, yours faithfully,

MAGNUS OHREN, A.J.C.E.

Gas Works, Sydenham, Kent, S.E., Sept. 19th, 1859.

SCREW SHIPS OF WAR.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Could not the screw of a ship-of-war be surrounded by a grating which would protect it from the débris of falling masts, &c. The grating might be placed at such a distance as not to hinder the flow of water, and still be a sufficient safeguard.

I am, your obedient servant,

TRIAL.

Mr. Newall passed through Malta for Alexandria this week, to lay a telegraph cable from Egypt to Turkey, and another across the mouth of the Adriatic. When finished this line will connect the Red Sea telegraph with England.

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DR. HOPKIN'S THEORY OF A CENTRAL FIRE.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—It appears natural for the common mind, so soon as it has become acquainted with any phenomenon, to set about and try to account for it, and to build thereupon facts which are but slightly corroborated. Thus as to the fossils found in coal strata, they look like vegetables, therefore they must once have been growing upon the surface of the earth. So of Dr. Hopkin's theory of a central heat (in your last number, p. 183), it has been found that the heat increases in a certain ratio, and must, at a certain depth, become red hot. Yet with only this single fact to support so large a theory, were there no other way of accounting for this increase of heat, it is not unreasonable to give our assent to it. But if it can be found that this increase of heat may be accounted for on principles to which assent will be at once yielded as being open and easily comprehended, then, I think, our assent may not reasonably be withheld—the former set aside, and the latter adopted. I think this heat found in mines may be accounted for in the same way as some other natural phenomena—the heat of the human body and of hot wells. Before constructing any new theory from isolated facts, it would be well to look round us, and see whether any question arising upon them would not be settled by reference to some already-known law of nature—which "acts by general, not by partial laws." One general law is that all substances on passing to a more solid state give out their latent heat, which at once becomes sensible; part of the air drawn into the human lungs at every inspiration becomes a solid or more dense fluid, and the latent heat required, in its aëriform state, is converted into sensible heat, giving life and warmth to the body. Part of the water passing through calcareous rocks, as Dr. Hopkins says, of low conductive power, becomes solid, filling crevices in the rocks, forming stalactites in the caverns, and giving out its latent heat, which becoming sensible in the water passing on is the cause of our hot wells. So water percolating through coal and other strata ultimately becomes wholly solid, and must give out its caloric of fluidity to the surrounding strata, which is, perhaps, the heat we find, and which has given rise to the notion of a central fire.

I am, Gentlemen, your obedient servant,

T. L. H.

19th Sept., 1859.

THE NAVIGATION OF THE AIR.

The navigation of the air—a subject respecting which many of our readers entertain very sanguine expectations, and in reference to which very much has doubtless to be discovered, and as much done—is ably and usefully discussed in the following letter which appeared primarily in the leading journal the early part of the present week. The principle from which the writer starts is, that if we are ever destined to navigate the air it will be by a strict adherence to the principle and a close imitation of the means which have been designed by the Creator for effecting the same purpose in flying animals. He proceeds as follows:—

Be it observed, then, that none of these animals are lighter than the air; on the contrary, their being heavier will be found to be a necessary condition of their flight. It is from their weight that they derive momentum, and without momentum they might float but they could not fly. We sometimes speak of a bird's flight being "buoyant," but this is only a mode of expressing the greater facility with which some birds fly as compared with others. No bird is ever for an instant "buoyant" in the literal sense of that word. Gravity never for a moment ceases to act upon its body, and on the slightest accident the force of gravity brings it heavily to the ground. The sustaining power in the flight of birds is the energetic action of their wings upon the resisting medium of the air. The comparative power of flight in birds depends on the proportion between (1) their weight, (2) the atmospheric area covered by their wings, and (3) the force with which the wings are worked. It is not the lightest bird with the largest wing which flies best or fastest; on the contrary, the flight of such a bird is generally laborious and heavy. The heron is a familiar example. Its body is extremely thin and light, its expanse of wing is enormous. Every one must have observed how slowly and heavily it flies. On the other hand, birds of the greatest weight, with the *minimum* size of wing which is compatible with flight at all, fly with enormous velocity. The divers are an example. Their wings are very small, mainly used as fins or paddles under water. The weight of the bird is very great; they have, consequently, much difficulty in rising into the air at all, but when once "under weigh" they go like an arrow. It is their great weight, and consequent momentum, which gives them this velocity. To counteract the great force which gravity exerts upon them, or rather to turn it into a horizontal instead of a perpendicular direction, the small wing is worked with almost inconceivable force and quickness. Nothing but the most rapid strokes could derive from so small an atmospheric area sufficient supporting power. Between these two extremes—the heron and the diver—there is among birds every variety of proportions between weight, area of wing, and flapping power. Each different proportion gives a different kind, and a varying power of flight. Some proportions are best adapted for "buoyancy," others for velocity, others for facility of direction. The power of flight, in all its combined conditions of lightness, duration, and perfect facility of direction, attains its *maximum* in some species of the swallow tribe, especially the "swift;" and in various kinds of sea birds whose wings are of very similar construction. The soaring of some birds is an apparent exception to the ordinary action of flight, and suggests to the eye the idea of actual buoyancy or floatation. But the exception is apparent only. The eagle or the vulture, when soaring, is not the less a very heavy bird, and the slightest derangement of his machinery of flight would bring him crashing to the earth. Weight is as essential to soaring as it is to progressive flight. The soaring of a bird is effected precisely as the same action is accomplished in a boy's kite.

This being the principle of flight in birds let us look for a moment at the means or machinery provided to satisfy these necessary conditions. A whole volume might be written on the structure of the wing in birds. In the whole range of nature there is no more beautiful piece of mechanism. But there is one main feature in its action which above all others deserves attention. The stroke of a bird's wing is always perpendicular, and this one action serves *both to sustain and to propel*. This is a result as well of the structure of the whole wing as of the structure of each feather. The feathers are all so placed with reference to each other that in the upward stroke they tend to separate and to allow the air to pass between them; while in the downward stroke they are pressed against each other so as to present to the air one impervious expanse, and thus to secure the greatest possible amount of atmospheric resistance. The same purpose is further assisted by the shape of the whole wing, which is slightly convex above and concave below. But beautiful as this mechanism is, the most beautiful part of the structure remains to be noticed—viz., that which converts the stroke *for sustaining* into a stroke for propelling also. This is a result of the structure of each quill, and of the direction in which all the quills are set. Each quill is highly elastic in substance, and in form tapers rapidly to the end. All the quills are so set that the elastic ends constitute the terminal and posterior margins of the wing. The anterior margin of the wing is rigid—being that containing the bone in which the quills are set. The consequence of this arrangement is, that the air, compressed by the downward stroke, escapes backwards, bending upwards in its passage the fine elastic tips; and thus exerting an upward and onward reaction on the whole body of the bird. It must be added that the same principle is followed in the wings of all flying animals; with much variety in the material, form, and disposition of parts. The wing of the bat is the most conspicuous modification—the more remarkable as in all probability it is on this model that artificial wings will be most easily constructed. By means of a leathery web stretched between long, attenated, and elastic bones, the fore-legs and fingers of a mammal are made to perform precisely the same functions as the pinions and quills of birds.

The problem of aërial navigation will never be solved until the principles of flight are clearly understood, nor until we recognize precisely what are the obstacles which prevent us from acting upon them by artificial means. It is, of course, possible that these obstacles may prove to be insuperable. I entertain a different impression, but, at all events, they cannot be overcome until they are exactly known. I believe them to be all summed up in one great deficit of our present mechanical knowledge—a light motive power. Steam is the greatest motive power among all that we know of yet, but the material required for the generation of steam, and the material required for the construction of its machinery, render it enormously heavy. We don't want buoyancy, but neither can we succeed with excessive weight. Every year is, indeed, adding to the perfection of the steam engine—to its compactness and to the amount of power which is derived from a given volume of steam. It is difficult to say what economy of weight might not be effected if ingenuity and science were specially directed to this object, and if the cellular structure adopted in the bones of birds, and which is already receiving so many new applications in mechanics, where strength and lightness are required, were applied wherever it is possible. Still, I have very little hope that, until a lighter motive power than steam is discovered, aërial navigation will be accomplished. But even with steam some experiments might be tried which would test the principles of flight, and at least lead the way in a right direction for the progress of discovery.

Not being myself a practical mechanic or engineer, I would suggest for the consideration of others some of the conditions under which such an experiment might be made. I assume that it would be easy to derive from a steam engine the perpendicular action of a bird's wing. In truth, the direct action of a piston would give this movement. I rather think this is the simple principle of Nasmyth's steam hammer. Would there be any difficulty in making such a piston work a pair of wings, constructed on some such model as the wings of a bat? What is the *maximum* velocity with which such a piston could be made to work a given area of wing? or, conversely, what is the *maximum* area of wing which such an engine could be made to work at a given velocity.

When these questions have been answered by calculation or experiment, the next step would be to ascertain the lifting power of such action. I have no hope that any steam engine can be made so light and so powerful as to work wings capable of lifting its own weight. But the important question is—*how much* of that weight can be so lifted, or rather (as no actual lifting would take place) how much of the weight would be deducted from the gross weight by the rapid action of the wings? Would it be any appreciable quantity? It is impossible to doubt that the amount of atmospheric pressure exerted by steam power working a vane or wing would be very considerable. The amount of such pressure would be the measure of the lifting power exerted, and might be tested or calculated in various ways.

Supposing, then, that a steam-engine could be constructed which could move wings equal to lifting 1-10th, or even 1-20th of its own weight, the difficulty remains how to deal with the re-

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mainder. In default of any other means of dealing with it, I would suggest that it be balanced by the lifting power of a balloon. In this combination, be it observed, the whole machine would not be buoyant. Even this modified use of a balloon is open to great objections, because the power exercised over it by the slightest current of air would be very great, and the experiment could only be tried in a tranquil atmosphere; but, in default of any machine capable of lifting the *whole* of its own weight, there seems to be no alternative but to take off part of that weight by a balloon. My belief is that such a machine, when its wings were put in motion, and when it rose from the ground, would be found capable of being directed, and that the direction of its flight would be determined by that in which its wings were *set*.

I have said that the wing of a bat would be found most easy of imitation. There is, however, one observation of great importance which may be gathered from the flight of different animals—viz., that, as regards facility of flight, the *shape* of a wing is even more important than the largeness of its area. Length is more important than breadth. Birds which possess the greatest powers of flight have always very long, but often very narrow wings. The swift swallow is an excellent example. Every one must have observed the extraordinary narrowness of its long wings. This peculiarity is carried to its extreme limits in the wings of the albatross, a bird of unwearied power of wing. The cause of this result is pretty obvious. Length gives leverage, and leverage is, of course, all-important in lifting power.

In a subsequent letter Mr. L. Morris writes as follows:—"It may be useful to point out a few errors into which he (the above writer) has fallen, and which can only have the effect of leading away from the path he wishes to pursue. He states that weight is essential to a bird's flight, as producing momentum; now this cannot be considered as essential, but as incidental. A kite is not sustained by the weight of the string, but in spite of it, although the string is incidental to its condition. We do not, in order to overcome the power of gravity, require an aërial machine to be proportionally heavy; on the contrary, the lighter it is the better. The writer also states that a bird is enabled to fly more swiftly and with greater ease in proportion to its increase of weight (within certain limits), when it must be evident that both the swiftness of its flight, and consequent momentum, entirely depend upon the speed with which the wings are moved, and its rate of progress can never exceed the rate of this movement. Your correspondent also observes that the 'soaring' of a bird is caused by the pressure of the wind on its outstretched wings, exactly as in the case of a kite. This action of the wind, however, could only produce a backward movement, and 'soaring' is evidently caused by the previously-acquired movement of the bird causing a resistance which for a time sustains it in the air; and this is the very principle carried out in previous attempts to construct a flying machine. It is sufficient to sum up by stating that the problem of aërial navigation will be easily solved whenever the progress of science shall place us in command of a motive power considerably lighter in proportion to its capacities than any steam-engine that can be constructed, and not till then. This is the true direction to which our aims should tend."

THE NEW STEEL.

We have this week had an opportunity of examining a sword-bayonet constructed of steel manufactured by Farrar's new process. This sword-bayonet has been put through all the tests ordinarily used to try such instruments, and has stood them with perfect success. The steel commonly used for such bayonets by the manufacturers of the weapon cost £81 per ton, whereas the Farrar steel employed in the present instance costs only about a third of that amount per ton. The value of Mr. Farrar's process may be judged of from these facts.

THE ASSOCIATION OF FOREMEN ENGINEERS.

On Saturday night last the anniversary dinner of the "Association of Foremen of the Engineering Trade" took place at their rooms, 35 St. Swithen's-lane, City. At seven o'clock Mr. Newton, of the Royal Mint, who, it may be remembered, was elected chairman in place of the late Mr. Sheaves in January last, took his seat at the head of the table, and was supported by from eighty to ninety members and friends of the society. After dinner the usual loyal and complimentary toasts were drunk, being severally prefaced by brief but appropriate and able speeches from the president. In giving the "Prince Consort and the rest of the Royal Family" the chairman took the opportunity of saying that H. R. H. never distinguished himself more than when at Aberdeen the other day he paid homage to the votaries of science, and acknowledged himself a devotee at her sacred shrine. "Our Employers" was the next toast of the programme. The chairman in proposing this said he considered it to be a toast in which every individual member of the association must feel a direct and personal interest. It was not necessary to urge the complete and indissoluble identity of interest which existed between masters and foremen engineers. Not one among their own body would think of disputing such a position. "We one and all" said he, "are aware that employers cannot fail without foremen feeling the effects of their failure, and that in *their* prosperity is bound up our own fortunes." He must be permitted to say, however, that from the attitude assumed by engineering employers generally towards the Foremen's Association, he was afraid that they did not regard this intellectual, moral, and charitable union with the favour which it had a right to expect at their hands. It was certain that the masters' advantage was bound up in the welfare of those who served them, and it was unfortunate that so much coldness should be manifested towards a society such as that over which he had the honour to preside, by employers generally. Would that employers would attend their monthly meetings and learn from their own observation that their's was no unfair banding together for the purpose of coercing the labour market, but simply a union for mutual improvement and for provident objects. Would that an employer occupied to-night the chair he so unworthily filled! Mr. Newton then proceeded to say that he trusted from henceforth the Association of Foremen Engineers would emerge from the dark cloud which seemed to obstruct the vision of employers, and that the latter would join the society in large numbers as honorary members. He appealed to the representatives of the scientific press then present to put before employers into whose hands their journals fell, the views of the members of the association, and to incite them to lend their countenance to those who earnestly desired their friendship and co-operation.

Mr. Fowler, an employer, in responding to this toast, disclaimed to some extent the strictures of the chairman as to the isolation of employers generally from the interests of the society, and concluded by handing in his own name and subscription as an honorary member.

"Honorary Members and Supporters" was the next toast, and this was responded to by Mr. Blackett.

"Prosperity to the Association of Foremen Engineers" now claimed the attention of the assembled members of it, and the chairman having expressed his views of the importance of the institution, and his confidence in its permanent well-being and increasing usefulness, called upon the secretary to furnish from his minute book the substantial reasons he had for forming those conclusions. Mr. Jones then proceeded to read an abstract report of the society's rise, progress, and present prospects, the substance of which we subjoin:—

"Sir, I have the satisfaction of presenting in compliance with your request, a brief history of the Association of Foremen Engineers, with some account of its present financial condition. In the year 1852 several members now present, together with Mr. Sheaves, now, alas! no more; Mr. Allison, whose unfortunate accident we all deplore, and myself, first met to discuss the desirability of forming an association of foremen of the various branches of the engineering trade. The matter was fully considered on these occasions, a committee was formed, meeting nights, once or twice in each week, were appointed in order to frame rules and to make regulations, and ultimately from those small beginnings grew into existence the now flourishing society of which we are all so proud. It must, however, in justice to the memory of our late lamented chairman, be admitted that the idea of such a society originated with himself. The following brief statement will enable our new members and friends generally to trace the course of the association since that early period of its history, and to understand its present numerical and financial condition.

Date.	No. of Members.	Contributions. £	s.	d.	Honorary Members.	Donations. £	s.	d.	Entrance Fees. £	s.	d.
1852–3	24	23	4	0	4	8	8	0	12	10	0
1853–4	22	36	10	0	6	7	7	0	1	0	0
1855	21	21	7	6	8	3	3	0	1	0	0
1856	24	36	3	0	8	1	1	0	6	0	0
1857	27	36	6	6	11	10	10	0	8	0	0
1858	36	53	2	6	16	16	16	0	8	0	0
1859, prcs. time	47	48	0	0	19	4	4	0	10	10	0
Contributions		254	13	6		51	9	0	47	0	0
Hon. Members		51	9	0							
Entrance Fees		47	0	0							
Total		353	2	6							

Against which our disbursements and incidental expenses are as follows:—

Date.	Unemployed. £	s.	d.	Deaths. £	s.	d.	Incidental. £	s.	d.
1852–3	11	0	0	—	—	—	6	17	7
1853–4	—	—	—	10	0	0	4	10	7
1855	2	0	0	10	0	0	6	2	0
1856	16	0	0	—	—	—	2	9	10
1857	—	—	—	—	—	—	9	11	8
1858	38	0	0	10	0	0	13	13	10
1859 up to pres. time	35	0	0	10	0	0	13	3	3
	102	0	0	40	0	0	56	18	6
Total							198	18	6

	£	s.	d.
Receipts, Donations, &c.	353	2	6
Disbursements	198	18	6
Available Funds	154	4	0
Interest	10	11	6
Total balance in hand	164	15	6

"Having thus shown you a copy of the whole of our receipts and expenditure as well as the number of members in each year of the existence of the society, I think that you will be willing to admit that we have not been associated for an idle purpose. Our funds have been made available on all legal occasions for the assistance of members, whilst they have solaced the widows and orphans of such as have departed to that bourne whence no traveller ever returns. It may be further stated that during the present year valuable papers have been read at our ordinary monthly meetings by Mr. Newton, our chairman, on 'The Influence of Mechanical Science and Mechanical Men on the Age in which we Live.' By Mr. Keyte, on 'The Making of Heavy Iron Castings.' By Mr. Briggs, Senr., on 'The Concussion of Water.' By Mr. Stabler, on 'The Economical Formation of Steam.' And by Mr. C. F. Hayes, on 'The Manufacture of the Rifle.' These and the discussions which followed them have tended in no small degree to the elevation of the institution, and the edification of its members. The library fund, a separate and distinct affair from the general fund, I regret to say languishes somewhat, and though we have to thank Mr. McGregor especially for a donation of books, yet the library is not quite what it ought to be. I think, Mr. Chairman, that the report may be deemed on the whole satisfactory, and I look confidently forward to the future of the 'Association of Foremen Engineers.'"

The reading of this statement elicited much applause, and silence being restored, the chairman proceeded to give, as his next toast, the "Scientific Press." Alluding to the statement of the secretary, and trusting that the representatives of the press then present would ensure it the publicity of their columns, Mr. Newton proceeded to observe that much of the recent success which had attended on the society was due, as he thought, to the notices of their monthly meetings, which had been regularly published in the various journals which constituted the scientific press of London. In eulogistic terms the chairman then gave the toast, which was drank with "three times three." In obedience to the request of the chairman, Mr. E. J. Reed, of the MECHANICS' MAGAZINE, as the senior member of the press present, responded to the toast. In his address Mr. Reed alluded to the importance of the class of men who constituted the foremen engineers of the kingdom. He pointed out the unrecognised influence which they exerted in the promotion and successful carrying out of all engineering works, and incited them to persevere in the pursuit of mutual improvement for which the association offered such facilities.

"Success to the Engineering Trade" succeeded, and Mr. Keyte acknowledged it. Then came the "Founders

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of the Association," and a response on behalf of the surviving founders by Mr. Briggs. "Our Visiting Friends," prefaced in a kindly tone by the chairman, was drunk, and Mr. Robertson, in a talented speech, acknowledged the honour conferred. The "Health of the Chairman" was next proposed by Mr. Keyte, who described that gentleman as "an able mechanic and a clever man," which he said well qualified him for his post. This was received with an amount of enthusiasm and of what are called "musical honours," which must have amply repaid the chairman for his exertions on behalf of the society. The cheers for Mr. Newton made this part of the proceedings quite an ovation. Under the manifest influence of strong emotion, the chairman thanked the assembled foremen for the warmth with which his name had been received, and promised to devote his whole energies to the welfare of the society. He regarded, he said, mankind as the agents of a higher Power, and bound, therefore, to develope the good promptings of the mind into deeds of kindness and love. Gratefully he returned his warmest acknowledgements, and proud indeed was he to possess their good opinion. The health of the secretary was next proposed by Mr. Ross, and duly responded to by the former. The health of the treasurer was pledged by Mr. Keyte, and the "Managing Committee and Librarian" was proposed as a toast in a neat speech by Mr. Stabler, Mr. Briggs returning thanks. Mr. Suffield gave "The Ladies." These pleasant proceedings, unmixed by one dash of alloy, brought twelve o'clock too speedily, and the National Anthem concluded a delightful meeting.

It may be stated that the address of the Secretary is 7 Arlington-square, New North-road, Islington, London, and that country foremen are eligible as members.

Our Weekly Gossip.

IN searching the annals of the coinage of Great Britain some curious facts have been disinterred from musty volumes and age-worn parchments. Few persons probably, for instance, are aware, as we were not until lately, that the term "bawbee," as used by our northern friends, was the legitimate name of a current copper coin once circulating beyond the Tweed. Towards the end of the reign of Charles II. this coin came into existence, and passed for sixpence. The "bawbee" had for its obverse impression the King's bust facing his right, His Majesty's name abbreviated, numeral and titles; and for its reverse, *Nemo. Me. Impvne. Lacesset.*, and the date 1677, with a large thistle crowned. The weight of the "bawbee" was about 130 grains. Coins called "bodles" had circulated in Scotland before the period in question, but Charles II. seems to have had a *penchant* for creating new coins, and for giving new impressions to them, he therefore ordered "bodles" to be struck equal in value to twopence only, in place of threepence, as previously. The "bodle" of this monarch bears a similar device as an obverse to that on the "bawbee," with a sword and sceptre under a crown, and a reverse similar to that of the "bawbee," except that the thistle is not crowned. The weight of the "bodle" is about one third that of the "bawbee."

It is a curious fact, and somewhat apropos to the coming coinage of mixed metal, that the *Merrie Monarch* had a peculiar horror of mixed materials for coinage. It was ordered, for example, in the year 1661, that "three thousand stone weight of *pure copper*, without any mixture of brass," be forthwith coined for circulation in Scotland. "Two thousand stone weight of said copper to be coined within three years after the date hereof, and the third thousand within such time after the expiration of the three years as the Lords of the Secret Council shall judge meet, and who are to resolve upon the impression and circumscription to be stamped upon the pieces." When will the "Lords of the Secret Council" of our own time come to a decision as to the "impression and circumscription" to be put upon the new bronze pieces which the Government have determined to issue. It is rumoured that there are great differences of opinion among them on the point, and that a strong determination is manifested in one quarter to keep Britannia, King Charles' Lady Stewart, seated as of old upon the rock supposed to be on the sea shore. *We* still hold that public competition among artists and engravers is the proper course. Has no engraver the public spirit to produce a set of designs for the mixed metal pence, halfpence and farthings? Speaking of the Scottish coinage, it may be stated that in the reign of James II. no copper coins were issued; that in the reign of William and Mary more "bawbees" and more "bodles" were coined, the first having on the obverse the busts of the King and Queen, and their names, and the second on the obverse the initials of their majesties in cypher in the field, instead of the sword and sceptre, and only their titles circumscribed. The last distinctive copper coins for Scotland were struck during the reign of William III., and bear date 1694, and no "bawbees" or "bodles" have been minted since that time.

A French agent, who is stated to be a distinguished naval officer, pre-eminent for his nautical knowledge and experience (and whom, we believe, to be Admiral Paris, *Major-General Maritime* of the port of Brest, and with whom we had much pleasant and instructive intercourse on board the Great Eastern), bears testimony, in a letter published in Wednesday's *Moniteur*, to the enormous strength and indubitable safety of the Great Eastern, and to her victory over the ocean. With regard to the first point, the naval officer says: "Nevertheless, it may be said that the destruction of the forward funnel of the Great Eastern might have happened to the smallest steamer, and would probably have occasioned its total destruction, because it would not have presented the mass and solidity of the great ship, while the accident in question in nowise compromises the future of this last." With respect to the second point, the same authority says: "The little swell while going against a strong head wind, and a heavy sea on, proved that *the nautical problem has been solved* (the italics are his own). If there be any doubts, they can only be as to her rolling, because she experienced no slanting heavy seas, and the vessel was too light to be considered in her normal position. But when, with the wind right ahead, she oscillated up and down hardly a quarter of a degree, while the neighbouring vessels plunged into the waves, and her sharp bows threw up less spray than a boat, one feels convinced that no sea can stop her, and that she cut through the waves with too great a force and facility for them to retard her progress, or for them even to produce that pitching which is so inconvenient to passengers. Contrarywise to so many ships of rounded lines, which the sea tosses and retards more than does the wind, the Great Eastern meets with no impediment from the waves. She cuts them too easily to feel their rapid motion; the wind appears the only obstable which nature can present; and all who are acquainted with navigation know how slight its action is in comparison with the action of the waves. Thus the trial which has just been made proves that this gigantic mass will always overpower the sea, and that she will not feel even the effects thereof, except when the waves strike her sideways. But then, again, the weight of the vessel and her length will diminish her motion, as was proved during the voyage, when, from the breaking of some part of her steering gear, she was thrown into a position to present her broadside to the sea."

The following clever piece of vaticination, taken from a leading article in the *Times*, is well worth reading:—"A thousand years hence, if the world last so long, we shall have 'Railway Antiquities.' At the meetings of perambulating associations papers will be read on the origin and early struggles of this or that line. The sketches of a primitive locomotive will then be as curious as the picture of a Chinese junk or the Royal Harry, in which Henry VIII. set forth to the Field of the Cloth of Gold. Bits of old rail will be handled and passed to and fro, with remarks on the quality or make of the iron. Here and there a bridge or a viaduct will be shown to illustrate the waste of material natural to a semi-civilized age, and the preference of finery to simplicity. Architects will remark on the absurdity of our making a railway train pass over a Doric entablature, or placing a booking-office under the Temple of the Giants. Should there ever be discovered a means of locomotion sufficient to scale greater inclines than are now possible, our prodigious tunnels, cuttings, and embankments will then be as mere curiosities and as decided proofs of our scientific ignorance as the aqueducts of Rome. They will be classed with pyramids and sphinxes, as the mere follies of power and wealth. Nevertheless, the earthwork will stand. It will never answer anybody's purpose to level a huge embankment or fill up a cutting. Costly as it was to make, it will be more costly to unmake; there will be no object, and the funds will not be forthcoming. So, should the world last a thousand or ten thousand years, 99 per cent. of our earthworks will stand just as they are. So stand the barrows, and dikes, and hill-camps, which are uncertainly referred to Britons, to Romans, to Danes, and every tribe that existed before the Conquest. Stones are removed, marble is burnt for lime, ashler work is stripped away, even concrete crumbles, the copper tie attracts the plunderer, everything perishes or is destroyed, but solid earth remains. There it lies; it neither moulders nor rusts; nobody carries it away; it is neither blown up nor ploughed over; earth it was, earth it is, and earth it will remain. So, as we say, ten thousand years hence our railway earthworks will remain. There will then be a hundred thousand miles of rail, and every village will have its branch; and there will be a series of *Bradshaws*, with their maps complete, purchased at the rate of 2*l.* a-number, in the British Museum, and there will be no difficulty in distinguishing an ancient line of 1859 from the modern addition made in the reign of Albert XXIII., A.D. 6859. A single peck of the mound will show the difference of the soil, and the production of a time-table will set at rest the question whether or not there was a line in the 19th century between one place and another. Many laments will be made over the unhappy convertibility of paper, which will then have reduced so many interesting records to the original pulp. Even a palimpsest, it will be observed, can be made to reproduce its six or seven strata of ancient lore; but piles of journals, archives of railways, *Herepath* and *Bradshaw*, pulp they were, and into pulp will they have returned."

The *China Telegraph* communicates the following facts respecting telegraphic progress. Messrs. Newall and Co's steamers Imperador and Imperatriz will be ready to leave Liverpool at the end of the present month, with the remainder of the cable to connect Kurrachee with Aden. The cable to connect Alexandria with this country is now to be laid through the Islands of Rhodes and Schios to Constantinople, and not by way of Candia, as previously intended. It is expected to be laid in about a month by Messrs. Newall and Co. Captain Pullen, of the Cyclops, has fixed on Hallani, one of the Kooria Mooria islands, as a station for the Red Sea telegraph.—A contract has been made with the Gutta Percha Company, on behalf of the Government, for a cable to be laid from Falmouth to Gibraltar, 1,200 miles, which is to be ready in June next. This will be succeeded by one from Gibraltar to Malta and Alexandria, thus giving an independent line, free from Continental difficulties.

We have before us a circular headed "Universal Peace throughout the World," which informs us that "Speedily will be published, with engravings, the particulars of a new peace-inducing system of aggressive warfare, so overwhelmingly destructive in its results, that nations could not exist if brought to bear against them for any protracted length of time, the very knowledge of which (without ever being put to the test), it is believed, when duly appreciated by mankind, must inevitably become the forerunner of peace throughout the world, by making it evident to the meanest capacity, that all standing armies, town and coast fortifications, rifle clubs, vessels of war, and national defences of every kind, would not only be perfectly inefficient, but absolutely powerless to resist, prevent, or lessen in the slightest degree the dreadful consequences of a well-directed attack upon this principle, which in point of cost (as compared with every other system of warfare) would be trivial in the extreme, and of which particulars a brief statement has been already forwarded to the Government, several Members of Parliament, and the Lord Mayor of London." It will only be fair to say that this document proceeds from Mr. W. H. James, C.E., who describes himself as the "(assistant) surveyor of the Liverpool and Manchester and Bolton railroads in the year 1821, and eldest son of the real (but unrequited) originator and founder of the modern railway system." What a happy prospect we have to thank Mr. James for!

NOTICES.

P. S.—It is seldom an easy thing to refer correspondents to situations that will suit them; and in your case we have not, of course, the slightest knowledge of what you are fit for, or of what is fit for you, otherwise we would gladly aid you if we could.

JAMES PARKER, *Camberwell*.—Your letter reached us too late to find a place in this number, but we hope to give it next week.

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CORRESPONDENT'S QUERY.

ENDLESS BELTS.

MR. EDITOR,—Will you be so good as to enlighten me on the following?

Suppose (working parallel to each other) two broad endless belts, each two feet diameter, and each stretched over two cylinders or axles, what should be the relative sizes of the cylinders or axles in order to ensure uniform simultaneous motion of the said belts. Your answer will oblige

Yours respectfully,

NOVICE.

September 19, 1859.

[We must commit this and all such inquiries to the attention of correspondents.]

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 472.

BOILERS AND THEIR FURNACES, &c., 409.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 424, 448, 460.

SHIPS AND BOATS, including their fittings, 425, 437, 449, 461.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 481.

FOOD AND BEVERAGES, including apparatus for preparing food for man and animals, 451.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 407, 457, 463, 465, 466, 468, 470.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 427, 433, 443, 445, 462.

LIGHTING, HEATING, AND VENTILATING, 413, 441, 467.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 416, 421, 422, 450.

METALS, including apparatus for their manufacture, 418, 419, 447.

CHEMISTRY AND PHOTOGRAPHY, 444.

ELECTRICAL APPARATUS, 434, 458.

WARFARE, 406, 471.

LETTER PRESS PRINTING &c., 453.

MISCELLANEOUS, 408, 410, 411, 412, 414, 415, 417, 420, 423, 428, 429, 430, 432, 435, 436, 438, 439, 440, 446, 452, 454, 455, 456, 459, 464, 469, 473, 474, 475, 476.

406. W. E. NEWTON. "Improvements in breech-loading fire-arms." (A communication.) Dated Feb. 12, 1859.

This invention is not described apart from the drawings. *Patent completed.*

407. W. E. NEWTON. "Improvements in sewing machines." (A communication.) Dated Feb. 12, 1859.

This relates, 1, to the manner of drawing the thread through the fabric after the stitch has been completed, and the required tension given to it; and to effect this end the needle used is of the kind known as the double-pointed needle, which is made to pass back and forth through the fabric, and is caught and held at each operation by suitable holding instruments. The loose or free end of the thread is drawn through the fabric by a hook or hooks attached to a travelling endless band. It consists, 2, in alternately gripping and releasing the needle from the needle bars as it passes back and forth through the fabric, carrying with it the thread to form the stitches. It consists, 3, in the arrangement of an adjustable presser foot, to answer the twofold purpose of guiding the needle to the upper needle bar, and to press the thread against the needle to give the necessary tension to the stitch. *Patent abandoned.*

408. J. PARKINSON. "Certain improvements in coffins." Dated Feb. 14, 1859.

This consists in manufacturing coffins or burial cases of earthenware, such as the brown ware made of ordinary clays, or of finer descriptions, such as china clays, or other similar plastic material; or they may be made of ordinary clay, and veneered with clays or cements of finer qualities, and they may be coated both inside and out with a vitreous enamel or glass. *Patent completed.*

409. T. HUNT. "Improvements in steam-boilers or generators, and in the prevention or combustion of smoke." Dated Feb. 14, 1859.

This consists, 1, in the use of transverse flue spaces or chambers having one or more openings made through each, but so arranged that the openings in one chamber are not exactly opposite to those of the next chamber, the whole being placed in the barrel of the boiler of a locomotive engine, or in that portion of a multitubular boiler usually occupied by the tubes and flues. 2. In combining these transverse chambers with tubes, the latter being fixed at the end of the boiler, or flues, or transverse chambers, next the chimney. 3. In arranging the transverse flue spaces in boilers having two or more furnaces or flues, so that one set of transverse chambers may be used in common to all the furnaces, or have a separate series of chambers to each. 4. In constructing the fire-boxes of multitubular or locomotive boilers with a water space or midfeather attached to the tube plate and to the crown plate, such water space projecting a portion of the distance towards the opposite side of the fire-box, by which the direct current of the gases is diverted from the entrance to the transverse partitions or flues, and thrown towards the fire-door plate through which, or the side plates, atmospheric air is admitted to ensure the prevention of smoke. *Patent completed.*

410. C. SANDERS. "Certain improvements in ornamenting English passe-partouts for photographic pictures, also the glasses used with the same, and which said modes of ornamenting are also applicable to ornamenting photographic frames generally." Dated Feb. 14. 1859.

This consists in applying to photographic mounts the well-known process or processes of gilding, painting, staining, etching, or printing, singly or combined, the inner side of the front glass, around that portion that does not intercept the picture or the moulding that surrounds it. *Patent completed.*

411. J. WRIGHT "Improvements in reducing and rolling steel and iron wire, and other forms of those metals in long lengths." Dated Feb. 14, 1859.

This consists in winding the wire to be reduced on a cast-iron bobbin or reel, which is then placed on a box of the same metal, and the whole placed in a furnace and heated to the required degree. The wire while heated is passed through rolls and rolled flat, as for watch springs or crinoline steel. There are modifications included. *Patent completed.*

412. J. L. CLARK. "Improvements in the means of working railway signals and switches." Dated Feb. 14, 1859.

In order to work railway signals and switches, the patentee arranges at or near the foot of the signal post, or at or near the switch, two hydraulic cylinders, each furnished with a pipe leading to the place from whence the signal switch is to be actuated, and at this place is a force pump or pumps, by which water may be forced through one or other of the pipes into one or other of the hydraulic cylinders. The pistons or plungers within the cylinders are connected with the signal or switch to be worked in any convenient manner; and they are also connected together so that when the piston or plunger of one of them is forced forward by water being injected into the cylinder the plunger or piston of the other cylinder is pushed back to its original position, and the water which the cylinder contained is caused to flow back by the pipe to the place where the force pump is situated, and there it is caused to flow into a measuring vessel, so that the person working the force pumps may know by the quantity of water returned by the pipe when the required amount has been produced. The employment of the return water to give this indication is the peculiar feature of the arrangement which renders it superior to the systems heretofore proposed for actuating signals and switches at a distance by hydraulic power. *Patent completed.*

413. J. COPCUTT. "Improvements in obtaining light from gases." Dated Feb. 14, 1859.

In obtaining what is called oxy-hydrogen light by directing a jet of ignited gas on to lime or a prepared material, the patentee has found that a better effect is obtained by employing the gases at a far greater pressure than the apparatus now employed will admit of. *Patent completed.*

414. R. CLEGG, F. ANGERSTEIN, and J. W. PAGE. "Improvements in making soap." Dated Feb. 14, 1859.

The patentees take one cwt. of the silicate of alumina, and half-cwt. of carbonate of soda in crystals, boil in the water of crystals till on dropping a test quantity on a cool slab it shall appear quite hard; call this A. Then they take one cwt. of the silicate of alumina, 100 cwt. of carbonate of soda, and 10 gallons of water, boil them together for half-an-hour, when they will become amalgamated. Then add of brown resin one cwt., and continue the boiling, when the whole will become a homogeneous mass; then add 56 lbs. of the product of the first process called A, and when sufficiently stiff, pour into moulds, and cut into bars. Take of tallow 14 lbs., caustic soda or potash 14 lbs., boil together, adding fresh alkali from time to time, till the soap is perfected; or of this add as much as the quality or character of the soap requires; while hot incorporate, and pour into moulds. *Patent completed.*

415. A. B. CLARK. "Improvements in discharging sewage and water from lands into tidal rivers, and in flooding lands therefrom, also conveying sewage and other waters or liquids across canals and over structures, part of which said improvements being applicable as a substitute for sluice cocks and valves." Dated Feb. 14, 1859.

The objects of this invention are effected by means of a hollow vessel in the form of a magnet. The action of this vessel is regulated for draining land by the ebbing and flowing of the tide. In discharging or conveying water, &c., across canals, &c., the invention consists in constructing a curved hollow channel extending from the part to be discharged to the part to be filled, so that by exhausting such channel of air, the water, &c., will rise therein, and filling the same will flow through it until the balance of pressure is equal at both extremities. *Patent abandoned.*

416. E. H. ALDRICH. "Improvements in ladies' dress caps." Dated Feb. 15, 1859.

This consists in securing the ordinary materials, such as lace, &c., to the common bobbin net foundation by cement, through the medium of heat and pressure by suitable blocks, and attaching flowers, &c., thereto by metallic ties or fastenings. *Patent abandoned.*

417. C. L. ROBERTS. "The manufacture of an improved cigar." Dated Feb. 15, 1859.

This consists in enclosing within the ends of cigars during manufacture tubes or mouth-pieces of glass, &c., so formed as to admit of one end being readily held within the mouth of the smoker whilst the other is firmly imbedded in the cigar. *Patent abandoned.*

418. R. MUSHET. "Improvements in the manufacture of steel, iron, and cast-steel." Dated Feb. 15, 1859.

This consists in combining cast-iron, decarbonised or partially decarbonised, by passing air through it whilst in the fluid state, with welding cast-steel obtained by melting suitable materials in melting-pots or crucibles heated in ordinary steel melting furnaces, the union of the said welding cast-steel and decarbonised cast-iron being effected by mixing them together whilst both of them are in a melted state, to obtain thereby malleable steel iron or steel suited for commercial purposes. *Patent completed.*

419. F. WALTERS. "The application of the waste heat from puddling furnaces." Dated Feb. 15, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

420. W. RAYMOND. "An improved life-raft." Dated Feb. 15, 1859.

The inventor employs two semi-cylindrical vessels of corrugated sheet iron, with tapering round ends, the concave portions to be filled in with cork, &c., attached thereto with marine glue, over which he places a complete covering of cork. He then places a covering of canvas, secured by a casing of cork, the whole to be secured by corrugated galvanized iron bands at intervals. There are various other details in connection with the fittings of the raft. *Patent completed.*

421. J. PATERSON. "Improvements in brace buckles and loops, and in braces." Dated Feb. 15, 1859.

This consists in carrying down a piece of metal from the lower bar of the buckle or loop, and in turning up this piece of metal towards the bar so as to form a pipe or tube for the chain or catgut carrying the cords to run in. It also consists in attaching leather tabs to tab chains by eyelets, and a piece of metal attached to each end of the chain. *Patent completed.*

422. J. T. JONES. "Improvements in sewing machines." Dated Feb. 15, 1859.

This comprises various improvements in sewing machines, the details of which are too voluminous for us to quote them at sufficient length for an intelligible abstract. *Patent completed.*

423. G. BEDSON. "Improvements in joining wire for telegraphic and other purposes." Dated Feb. 15, 1859.

This consists in placing the ends of the wires to be joined within a short tube, which the inventor then strikes with a punch. He prefers to galvanize the joints, or otherwise to apply molten metal, whereby the parts become soldered together. There are various modifications included. *Patent completed.*

424. J. F. TOURRIER. "Preventing oscillation of the last carriage of a railway train, and giving rigidity and steadiness throughout the train." Dated Feb. 16, 1859.

Oscillation is here prevented by placing the action of drawing at the two third back of the carriage, and a secondary or slight action of drawing at the one-third part of the same carriage. The whole is connected by chains or rods with the shackles now in use. The rigidity and steadiness is obtained by coupling chains fitting so as to assist the shackles and supporters to the carriage in case of need. *Patent abandoned.*

425. M. CRAWFORD. "An improved anti-fouling metallic varnish, applicable to ships' bottoms and other similar purposes." Dated Feb. 16, 1859.

The inventor mixes in suitable proportions plumbago or black lead, fine or gum varnish, arsenic, and spirits of turpentine. *Patent abandoned.*

426. S. BAILEY. "Certain apparatus for preventing the skip in mine operations being pulled over the

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pulley on which the rope or chain works, to which such skip or cage may be attached, as well as preventing the skip or cage re-descending until put in motion for that purpose." Dated Feb. 16, 1859.

The objects indicated in the title of this invention are effected by certain apparatus, the details of which are too elaborate to be quoted here. *Patent completed.*

427. R. COOKSON and C. W. HOMER. "Improvements in machinery for making bricks, tiles, tubes, and other articles of plastic materials, and in the mode of joining drain pipes." Dated Feb. 16, 1859.

This consists in a combination of machinery by which clay or other plastic material is supplied to a box furnished with a double-acting piston, from which it is forced through dies of the proper shapes for making bricks, tiles, tubes, and other articles. *Patent completed.*

428. C. E. WRIGHT. "Improvements in means or apparatus employed in the nursing or treatment of infants." Dated Feb. 16, 1859.

Here the child is placed in a basket or other receiver, and supported by bands connected to rings and a spring hook. *Patent completed.*

429. R. J. S. PEARCE. "Improvements in weighing and dynamic machines." Dated Feb. 16, 1859.

This relates to the application of a weight on a pendant lever, as the counterbalance to determine the weight of any body, in combination with a lever or series of levers and a circular dial and index-hand, showing the result of the weighing operation. *Patent completed.*

430. P. M. P. BOURJEAURD. "An improved apparatus for supporting the womb." Dated Feb. 16, 1859.

This consists of a mushroom-shaped vessel in caoutchouc with an aperture through the centre thereof, and connected to india-rubber or other straps for securing it to the body of the wearer. The vessel is hollow, and may be permanently sealed, or it may be connected with a pipe fitted with taps, and an air-bag for the purpose of inflating and letting out the air from the mushroom-shaped vessel as required. *Patent abandoned.*

431. W. E. NEWTON. "An improved mowing machine or grass harvester." (A communication.) Dated Feb. 16, 1859.

This invention is not described apart from the drawings. *Patent completed.*

432. A. V. NEWTON. "An improvement in the construction of brushes." (A communication.) Dated Feb. 16, 1859.

This consists principally of a method of fitting and fixing the bristles of cylindrical and other like brushes, which method is not described apart from the drawings. *Patent completed.*

433. W. E. NEWTON. "Improved machinery for making bricks." (A communication.) Dated Feb. 16, 1859.

Here a wooden drum is mounted horizontally in bearings, and actuates an endless cloth, which is passed round it and extends down to the ground, and is supported beneath by small rollers so that it may move with facility, and carry forward to the upper or feeding parts of the machinery the clay that is placed thereon. A chain-wheel on the axle of the drum is driven by a chain which passes round a smaller chain wheel on the axle of the feeding or crushing rollers which crush the clay and feed it forward to the pug mill. These rollers are so mounted and arranged that should stones, &c., be found in the clay the rollers will yield, but will be brought back to their original position by springs or counter-weights. The clay is conducted down to a horizontal cylinder, around which are arranged moulds for the bricks, each mould being fitted with a moveable piston. By the rotation of the mould drum, the moulds are brought under the action of a presser wheel, which forces the clay into the interstices of the moulds. The clay is submitted to a second presser, while the pistons are also pressed from behind. The bricks are forced out of the moulds by causing the rods at the back of the pistons to be brought against a wheel which will force them outwards, and deliver the bricks on to a plank or board placed on a travelling belt or cloth whereby they are carried out of the machine. *Patent abandoned.*

434. W. H. HORSTMANN. "Telegraphic cables and the mode of constructing the same and laying them down." Dated Feb. 16, 1859.

This invention is not described apart from the drawings. *Patent completed.*

435. J. J. RUSSELL. "Improvements in machinery used for heating and welding the edges of the plates used in the manufacture of cylinders and other articles." Dated Feb. 16, 1859.

Here a standard framing is used from which project two arms. These arms at their outer ends are arranged to receive dies or tools. The upper tool slides up and down between guides, and is actuated by a cam on a suitable axis, on which there is a cog-wheel driven by a pinion on the main axis of the machine, which is put in motion by a steam engine. There are two fires suitably placed for heating the edges of the plates to be welded. When the overlapping edges are sufficiently heated they are brought between the two dies and pressed between them. *Patent completed.*

436. W. A. O'DOHERTY. "An improvement in black-lead pencils and pencil cases." (A communication.) Dated Feb. 16, 1859.

This consists in manufacturing black-lead pencils with the lead running half way through, and india-rubber the other half. Also, in applying a piece of india-rubber to one end of a pencil case. *Patent abandoned.*

437. J. SEGUIN. "Improvements relating to the employment of moving power arising from the tides, and its application to manufacturing, agricultural, and other purposes." Dated Feb. 16, 1859.

This invention is not described apart from the drawings. *Patent completed.*

438. J. S. BENSON. "A new or improved method of silvering glass." (A communication.) Dated Feb. 16, 1859.

This consists in the use of a solution in water of nitrate of silver and tartrate of ammonia. *Patent abandoned.*

439. J. BREEDEN. "New or improved machinery for the manufacture of taps or stopcocks, and fittings for gas, steam, and water-pipes." Dated Feb. 16, 1859.

This invention is not described apart from the drawings. *Patent completed.*

440. J. EASON. "Improvements in apparatus applicable to tanning, dyeing, and obtaining extracts from vegetable, animal, and mineral substances." Dated Feb. 16, 1859.

This consists of machinery for the tanning of skins, hides, &c., by exhaustion and repletion, caused by hydraulic and hydrostatic pressure. The vessels or tanks the patentee uses for this purpose are composed of iron, wood, or other suitable material, either square or cylindrical, the former in ordinary cases being preferable if of sufficient strength to bear a pressure of from 100 lbs. to 1000 lbs. to the square inch, and are lined with marine glue, gutta percha, lead, copper, or wood as may be required, as the liquor used for tanning in coming into contact with the iron would tend to destroy its tanning properties. *Patent completed.*

441. S. T. COOPER. "Improvements in the use and application of artificial light." Dated Feb. 17, 1859.

The essential condition of this invention is the instantaneous ignition of jets of gas as they issue from a burner, by one or some of them inpinging upon and coming in contact with a fixed flame (which may be that of gas or of an oil or other lamp) kept continually burning, in combination with an arrangement whereby the gas is supplied from the main through a branch pipe and turned on to, or cut off from, the burner by the action of an ordinary shut-off cock placed at a distance from it. *Patent abandoned.*

442. G. GRAY. "An improvement in screw wrenches." (A communication) Dated Feb. 17, 1859.

The short-threaded screw which gears into the bar revolves on a shaft, the end of which shaft is made with a projecting thumb-piece, having a centre pin passing through both, and on one side of the shaft, so that by moving the excentric shaft round half a revolution the short screw is raised out of gear, thereby allowing the jaws to be opened to their fullest extent without the trouble of the continuous motion of the screw, which is merely pushed into gear for tightening the object to be held. There are other features included. *Patent abandoned.*

443. H. Y. D. SCOTT. "An improvement in the manufacture of cement." Dated Feb. 17, 1859.

In carrying out this invention, which is an improvement upon Scott's patent cement, as patented April 17, 1856, and Feb. 19, 1857, the patentee takes the above-named cement, if it is in lump, which he prefers, and grinds it down in an ordinary cement mill with an equal quantity by measure of chalk, using less or more of that material as desired. *Patent completed.*

444. B. SAILLARD. "An improved mode of obtaining printing-plates from collodion pictures." Dated Feb. 17, 1859.

This relates to the obtaining by the aid of the electrotype process metal printing plates from collodion pictures. *Patent abandoned.*

445. P. E. FRAISSINET. "A new or improved structure of iron, applicable to paving, flooring, bridges, gratings, girders, and other like purposes." Dated Feb. 17, 1859.

This structure is formed of hoop or other iron combined, some of the pieces being flat and others undulated, placed one edge juxtaposed and rivetted at the points of contact. *Patent completed.*

446. T. CATTELL. "Improvements in treating and purifying gutta-percha." Dated Feb. 17, 1859.

This consists in submitting gutta percha to the action of volatile solvents of two classes, in the proportion of one part by weight to about fifteen parts of solvent. The details are voluminous. *Patent completed.*

447. F. W. EMERSON. "Improvements in the treatment of certain ores of lead, and obtaining from them valuable primary and secondary products." Dated Feb. 17, 1859.

This consists in the treatment of certain ores of lead known as mendipite or oxchloride of lead, phosphate of lead, and the arsenio-chlorides and arsenio-phosphates of lead, native sulphated and carbonates of lead, and all those ores of lead, containing any combination of chlorine, phosphoric acid, arsenous or arsenic acid, carbonic acid, sulphuric acid, or any mixture of the same, so as to produce therefrom oxide of lead for the preparation of its various salts, as the acetate, nitrate, &c., and the various uses for which litharge is now employed, red lead, or minium carbonate of lead, and metallic or pig lead, and from the mendipite or oxchloride of lead a very durable and anticorrosive paint is obtained. *Patent completed.*

448. C. FAY. "Improvements in apparatus for working railway breaks." Dated Feb. 17, 1859.

This invention relates in great part to a former patent dated 18th Dec., 1856, and consists of various peculiar arrangements of mechanism for imparting a rotary motion to the longitudinal break rods of the train, whereby the breaks may be made partly self-acting and self-adjusting, so as to compensate for the wear of the blocks, whilst they are still free to be applied by the hand wheel of the guard when requisite. *Patent completed.*

449. J. H. JOHNSON. "Improvements in apparatus for propelling and steering vessels and other floating craft." (A communication.) Dated Feb. 17, 1859.

This consists in the application and use to and in the propelling or steering of vessels of a scroll-shaped box placed in a horizontal position beneath the surface of the water, and connected to the stern or other convenient part of the vessel. Within this box works a rotary fan or series of vanes attached to a vertical shaft which extends upwards into the vessel, and is driven by a steam engine or other power. A discharge mouth is made on one side of the circumference of the box, and an outlet aperture is made on the upper and under side of the same, both apertures being covered over by a hood or box having a mouth or opening in the contrary direction to the discharge mouth in the circumference of the fan-box or casing. To steer the vessel it is simply necessary to turn the main box round more or less, so as to alter the direction of the jet. *Patent abandoned.*

450. J. J. COLE. "Improvements in Venetian and other suspended blinds, and in the method of hanging and working them." Dated Feb. 18, 1859.

This consists in having a balance so made and hung as to counterpoise the weight of the blind to which it is attached, and in fixing or hanging the said weight to the lines which pass in the ordinary way over pulleys and through the laths of a Venetian blind, or through the rings, loops, or eyes of a blind of a flexible material. *Patent abandoned.*

451. C. GARTON. "An improved method of treating cane sugar, in order to render it fitter to be employed in brewing, distilling, and wine and vinegar making." Dated Feb. 18, 1859.

This consists in assimilating the properties of cane sugar to those of malt saccharum and fruit sugar prior to its being employed in brewing, distilling, or wine or vinegar making by heating it according to a certain process. *Patent completed.*

452. H. SWAISLAND. "Improvements in box sextants." Dated Feb. 18, 1859.

This consists in the combination of a compass card or needle with an ordinary or other box sextant, so that the bearings as well as the angles of lines may be simultaneously indicated, whilst the advantages of a pocket compass are combined with the sextant. *Patent abandoned.*

453. G. WALLIS. "A new or improved method of engraving, applicable to the production of printing surfaces and the ornamentation of metallic and other surfaces." Dated Feb. 18, 1859.

Here the inventor prepares a drawing upon paper of the design to be produced. The drawing is made with ink or composition containing gum arabic. He applies to the drawing emery powder or sand, which attaches itself to the adheaive ink, &c., and causes all the lines of the design to stand out in relief. He

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places the relief drawing between the metal plates, that plate upon the face of the drawing being the one to be impressed, and submits the whole to pressure. *Patent abandoned.*

454. G. KAMMERER. "Improved gearing for gins or horse mills, applicable for grinding, winnowing, and other purposes requiring motive power. (A communication.) Dated Feb. 18, 1859.

This consists of a central base or pedestal suitably bolted down, and on which is erected a central column the frame and pole of which the horse or other animal actuates. The mill is mounted and moves round on the lower part of this column. It carries a wheel or rim having internal teeth, and this wheel gears with a pinion fixed in a vertical shaft mounted on bearings supported by a central column; a wheel keyed on to the upper end of this shaft gears with a pinion mounted on a stud in the top of the column. This pinion is fixed to or cast of a piece with a bevil wheel also rotating on the same stud, which bevil wheel gears into a pinion whose axis is in direct communication with the shaft by which the motive power is to be transmitted. *Patent abandoned.*

455. W. CLARK. "Improvements in emptying cesspools, and in raising other fluid and semi-fluid matters." (A communication.) Dated Feb. 18, 1859.

Here the inventor projects steam into a metallic capacity, which by valves may be perfectly closed; the steam drives the air from the capacity, and the steam then fills the chamber. When the chamber is so filled all the valves are shut, and the steam thus enclosed condenses and produces a vacuum, and the vacuum chamber being by means of pipes in connection with the space from which the muddy matters, &c., are to be drawn, the said matters are thereby raised and enter the chamber. *Patent abandoned.*

456. W. CLARK. "Improvements in pressure gauges." (A communication.) Dated Feb. 18, 1859.

Here by the movement of a train the dial plate works two needles which move together as the pressure gauge is acted on by the steam, but these two needles do not return together to zero if the engineer has allowed the maximum pressure which he should keep in the boiler to be exceeded. The needle which remains to indicate the excessive pressure is furnished with a small wheel which rests on a fixed ratchet. The wheel has, 1, teeth at one part of its circumference in a certain position; 2, a smooth surface round its circumference. The parts are mounted so that when the maximum pressure is arrived at, the fixed ratchet gears one tooth, whereby the second needle is prevented returning with the first when the pressure of steam diminishes, which second needle will indicate on the dial plate that the regulation pressure has been exceeded, and to what extent. The invention also consists in a new kind of piston for the manometer. Also in a new application of india-rubber for closing the issue of steam in the manometer. *Patent completed.*

457. J. H. JOHNSON. "Improvements in the manufacture of textile fabrics, and in the machinery or apparatus employed therein." (A communication.) Dated Feb. 18, 1859.

This consists in the production of a new species of woven fabric wherein the weft threads are beaten up at various angles to the warp, or in undulating lines. Also in undulating certain of the warp threads in the production of these fabrics. *Patent abandoned.*

458. P. A. J. DUJARDIN. "Improvements in the printing apparatus of railway telegraphs." Dated Feb. 18, 1859.

This invention is not described apart from the drawings. *Patent completed.*

459. A. R. L. DE NORMANDY. "Improvements in the apparatus for obtaining fresh water from salt water." Dated Feb. 19, 1859.

This relates to a former patent dated 20th August, 1856, and the improvement consists in using a float composed of pottery, earthen, delfe, or glass ware. It also relates to the priming box, and consists in making the priming and feed box into one vessel. It also consists in a different method of constructing the sheaf, bundles, or series of pipes used for evaporating the sea water. *Patent completed.*

460. T. EARLE. "Improved apparatus for conveying signals to railway trains in motion." Dated Feb. 19, 1859.

This apparatus is constructed with a lever or levers, cam or cams, which when the train is in motion will be so pressed on or against as to act on some part of the engine or tender, or other part of the train, and cause a whistle to be blown or a bell to be rung. *Patent abandoned.*

461. W. CLAY. "Improvements in the manufacture of deck and other beams, and of angular and other bars of various forms." Dated Feb. 19, 1859.

Here the inventor takes the puddled steel in the form of a bloom or billet, and subjects it to the action of suitable rolls, whereby the blooms are rolled out into bars of the desired form. In preparing the pile he arranges the metal bars so as to have the fewest practicable number of external joints. There are modifications included. *Patent completed.*

462. W. BASFORD. "Improvements in the method of, and means for, drying bricks and tiles preparatory to their being burnt, and also in the construction of kilns or ovens for burning such bricks, tiles, pipes, pottery, or earthenware, and in the mode of charging or placing these said articles therein to be burnt or fired, and in certain appliances for regulating the heat therein." Dated Feb. 19, 1859.

The specification of this invention is too elaborate to be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

463. S. WHEATCROFT. "Improvements in the method of, and the means for, uniting lace to blond and other fabrics, and also in the apparatus used in manufacturing or converting the same into bonnet and cap fronts, rouches, and such like similar articles of millinery." Dated Feb. 19, 1859.

Here to unite lace and blond the materials are wound on separate reels, and then unwound from these, the blond travelling in one place, the lace in another more elevated. The former in its course passes one of its edges under a little slot guide, and is then carried beneath a piece of sponge fixed in the narrow end of a bent funnel which supplies water to it, so as to moisten and wet the edge of the blond, and dissolve the softening material with which it is dressed. Travelling on from this they then pass under a guide, which has a lateral adjustment for different sizes of fabrics, and into which the lace passes, and is by means of it caused to overlap the adjoining edge of the blond. The two fabrics afterwards come in contact with heated rollers suitably arranged. *Patent completed.*

464. C. F. VASSEROT. "An improved apparatus for manufacturing the strands of wire ropes." (A communication.) Dated Feb. 19, 1859.

This chiefly consists in mounting upon a common axis three rings or wheels of cast-iron, placed parallel and behind each other, the diameters of each regularly decreasing. Upon each of these wheels are mounted a number of bobbins, the number on each being proportionate to the number of strands or wires of which the composing strand is to be made. Upon each bobbin is mounted a wire, and all the wires are wound off the bobbins, and are all drawn and passed through an eye or converging guide, by which they are brought together. The combined mass is then fixed to a hooked rotatory spindle, and the required twist given to it; the bobbins are put in motion by pulleys and wheels. The strands being formed in this manner, a rope is then formed of a certain number of these strands as before. *Patent completed.*

465. C. F. VASSEROT. "An improved carding machine." (A communication.) Dated Feb. 19, 1859.

Here it is proposed to augment the carding surface by adding a third cylinder between the two now employed. This cylinder having a less surface than the large card, has a greater speed. *Patent abandoned.*

466. R. A. BROOMAN. "Improvements in machinery for doubling threads." (A communication.) Dated Feb. 19, 1859.

This apparatus is applicable to all descriptions of doubling machines or frames, whether the bobbins are set in a vertical or a horizontal position. To every bobbin in which the doubled threads are wound, there must be a separate apparatus. Any one of the bobbins in the frame may be stopped without interfering with the rotation of the others. The apparatus consists of three parts, one a pulley or toothed wheel fitted to turn loosely on the bobbin spindle, upon receiving motion from a strap, or from toothed gearing as the case may be; this pulley or wheel is provided with a projecting stud, which, when the parts are all in working order, is caught by a hook in which one end of a curved lever is made to terminate, the opposite extremity of which terminates in a projecting spur; this lever forms the second of the three parts, and is secured to the remaining part by a screw upon which it is free to oscillate. The third and remaining part is a collar terminating in a disc by means of a feather and pressure screw; the collar and disc are fixed on and revolve with the spindle. Each of the threads to be doubled passes through an eye on the outer end of a small lever, and while the threads are whole they keep the outer ends of the lever raised. The inner ends of the levers are turned up, and as long as no thread breaks the turned-up ends of the levers pass free of the projecting spur, and the apparatus, spindle, and bobbin rotate together; but upon the breaking of any one of the threads the inner end of the lever, through the eye of which the broken thread passed, tilts up and coming in contact with the projecting spur throws the hooked end of the curved lever free from the projecting stud, when the pulley or wheel will cease to carry round the other parts of the apparatus, and will revolve loose on the spindle. *Patent abandoned.*

467. F. P. J. VAN DEN OUWELANT. "Improvements in apparatuses to be applied to fire-places, for obtaining a more complete combustion of the fuel employed therein." Dated Feb. 19, 1859.

This consists in providing the said fire-places with one or more apparatuses through which either steam or air, or both, is caused to pass, and afterwards injected by a sort of screen in the fuel, in order to obtain thereby a better combustion of the gases evolved. *Patent completed.*

468. G. PAUL. "Improvements in spindles and flyers." Dated Feb. 21, 1859.

The mode of fixing the spindle and flyer together, which forms the subject of this invention, is susceptible of various modifications, according to one of which the spindle end is formed with a taper fitting or tapered socket formed in the flyer boss, the flyer being held in its place by a pin fixed in the end of the spindle, and which pin is passed through a groove in the socket of the flyer boss, and then turned round so as to lock it. The outer edge of the flyer boss which bears against the pin is inclined in opposite directions on each side of the groove, so that the turning round of the spindle in the flyer boss in either direction causes the pin to jam or wedge the flyer fast on the spindle. This mode of fixing is thus equally secure in whichever direction the strain upon the flyer may act. *Patent completed.*

469. O. BLAKE. "Improved machinery or apparatus used in the manufacture of glass." Dated Feb. 21, 1859.

The patentee performs the whole of the manufacture of glass from its rough state to its finish, by one set of machinery or apparatus, and on one bed or table. The improved machinery is not described apart from the drawings. *Patent completed.*

470. G. MCCULLOCH. "Improvements in machinery or apparatus for spinning, doubling, and throwing silk, and doubling other fibrous materials." Dated Feb. 21, 1859.

The inventor gives motion to the bobbins and spindles at any required difference in order to wind on, and also to obtain the desired twist, by attaching the spindle and bobbin to toothed wheels of different numbers of teeth, which difference is determined by the twist required. The said toothed wheels are put in motion by other toothed wheels having discs of leather resting upon the circumference of plain wheels placed upon a shaft extending from one end of the machine to the other. *Patent abandoned.*

471. T. WILSON. "Improvements in the manufacture and construction of ordnance." Dated Feb. 21, 1859.

This consists in making the barrels of ordnance of hollow cylinders or tubes of annealed cast-iron, the said tubes being of progressively increasing diameter, and fitted upon and connected with one another by the process of shrinking. Also in closing the breech end of ordnance by means of a screw carried by a bow strap or frame jointed to the ordnance, so as to permit the said screw being turned aside or out of the line of the fire when loading the ordnance. *Patent completed.*

472. A. BELPAIRE. "Improvements in the reversing gear of locomotive and other steam engines. Dated Feb. 21, 1859.

Here the reversing lever of the engine has a bearing piece which turns on two pivots or journals, and it has also two ears through which the screw passes, and by which it is held at the bottom of the bearing piece. A piece sliding in grooves in the bearing piece has a screw thread at its lower part, and gears into the screw from which it can also be disconnected according as it is raised or lowered by the catch. When the engine driver wishes to work the lever without the aid of the screw, he presses the catch, and when he wishes to displace the lever by means of the screw, he turns a wheel properly arranged in the required direction. The screw is mounted on a piece moving on pivots so that it can accommodate itself to any inclination corresponding with the position of the lever. *Patent abandoned.*

473. G. HUMPHREY. "Improvements in meters for measuring fluids and gases." Dated Feb. 21, 1859.

This consists of a case containing a circular plate or wheel revolving on an axis, and from which a number of fans or blades project, and travel in a race or course formed by corresponding projections in the case. The passage of the fluid or gas from the inlet to the outlet pipe gives motion to the fans or blades of the wheel, and thence to the ordinary registering dials. *Patent abandoned.*

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474. T. SPENCE. "Improvements in the manufacture of alum, and in the mode of, and apparatus for, condensing and destroying gases arising therefrom." Dated Feb. 21, 1859.

This relates to a former patent dated Nov. 27, 1845, and consists of admitting ammonia during the digestion of shale, so that the whole may be conducted in one vessel. The gases evolved are conducted into a condenser of a peculiar arrangement. *Patent completed.*

475. R. JOBSON. "Improvements in supplying water or other fluids to axletree boxes and other journal bearings to lubricate the same." Dated Feb. 21, 1859.

Here a close vessel to contain the lubricating fluid is connected with the axletree box by a suitable tube, so that when the fluid lubricator is at the desired level in the box the outlet end of the tube is covered by the fluid. By these means there will be no supply of the lubricating fluid from the close vessel into the box or bearing so long as such outlet from the supply tube is closed or covered by the water, &c., but so soon as the level of the water, &c., in the box or bearing descends below the outlet, and air can pass into the close vessel, the water, &c., will flow into the box or bearing until the outlet of the tube is again covered. *Patent completed.*

476. A. TAPERELL. "Improvements in compositions or compounds used when cleaning glass." Dated Feb. 21, 1859.

Here a decoction is made of Brazil wood, peach wood, and alum, which is mixed with sifted whitening, and also with a composition of soap and chalk. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Sept. 1, 1859.

1993. J. A. Simpson. Improvements applicable to hats and other coverings for the head.

1995. T. Aveling. Improvements in locomotive engines.

1997. R. H. Collyer. Improvements in preparing materials for the manufacture of paper.

Dated Sept. 2, 1859.

1999. J. Bernard. Improvements in the manufacture or production of boots and shoes, in the machinery, apparatus, and means employed in such manufacture.

2001. W. Brown, jun., and S. Bathgate. Improvements in machinery or apparatus for grinding or sharpening the card teeth of carding engines for carding fibrous materials.

2003. W. Fearn. An improved construction of buoys.

2005. S. D. Goff, H. Davis, S. Strangman, and E. Strangman. An improved method of, and apparatus for, drying malt, corn, and other articles.

2007. E. Button. Improved apparatus for raising sunken vessels.

Dated Sept. 3, 1859.

2011. J. Friou. Detaching instantly the locomotives from railway carriages, and also for detaching instantly the harness from horses that run away when attached to any carriage.

2013. H. R. L. Schramm. A new process for pressing and separating simultaneously the fibres and pellicles contained in the constituent matters of the beet-root sugar, beer, grains, alcohol, potatoes, beets, and other similar substances.

2015. W. Neilson. Improvements in steam-hammers.

2017. J. C. Nixon. Improvements in kitchen ranges with combined steamer and hot closets, for cooking, warming, drying, or other purposes.

2019. C. Schiele. Improvements in weighing-machines.

2021. B. Lauth. Improvements in the manufacture of rollers or cylinders for calico printers, and of tubes of copper and brass, or mixtures of those metals.

Dated Sept. 5, 1859.

2023. W. Bush. Manufacturing granulated scidleitz powder.

2025. J. W. P. Field. Improvements in breech-loading fire-arms.

2027. V. Tomell. Improvements in the manufacture of yeast.

2029. A. V. Newton. Improvements in weighing machines. (A communication.)

Dated Sept. 6, 1859.

2031. R. K. Goddard. Improvements in the method of, and apparatus for making pharmaceutical or other infusions.

2033. F. J. Manceaux. Improvements in cartridges.

2035. J. Stewart. Improvements in piano-forte actions.

Dated Sept. 7, 1859.

2037. J. J. Lyons. Improvements in the manufacture of sugar.

2039. G. Lawrence. Improvements in the construction of wheeled vehicles.

2041. W. J. J. Varillat. An apparatus indicating the level of water in steam caldrons or boilers.

2043. J. P. Joule. Improvements in apparatus for refrigerating and condensing steam or other vapours, which said improvements are applicable to refrigerating or heating liquids.

2045. A. V. Newton. Improvements in the manufacture of ladies' hooped skirts. (A communication.)

2047. E. T. Hughes. Improvements in machinery or apparatus for forging metals. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

2072. M. A. F. Mennons. An improved arrangement of piston packing, principally applicable to hydraulic apparatus. (A communication.) Dated Sept. 12, 1859.

2073. M. A. F. Mennons. Improvements in the construction of hydraulic pumps. (A communication.) Dated Sept. 12, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Sept.* 20, 1859.)

1138. F. Angerstein, R. Clegg, and G. Thorrington. Motive power.

1146. J. Combe. Measuring the hoofs of horses.

1164. E. T. Hughes. Motive power. (A communication.)

1165. T. Green, jun. Steam boilers.

1169. W. Wilkinson and C. Whitley. Buttons and fastenings.

1187. J. Leadbetter and J. Rhodes. Pumps.

1190. J. Saxby. Railways.

1191. R. A. Brooman. Solidifying, pressing, and moulding. (A communication.)

1192. A. P. Rochette. Soft soap.

1193. T. R. Oswald. Building ships.

1196. T. Scott. Surface condenser.

1205. J. T. Beale and T. N. Kirkham. Dyeing and printing.

1208. M. Leahy. Carriages.

1212. E. Maw. Buildings.

1213. J. Chatterton. Covering conductors.

1219. G. Allcroft. Pressure gauges. (A communication.)

1227. J. Nasmyth. Motive power.

1229. R. Romaine. Cultivating the soil.

1232. S. N. Evans. Preventing accidents at mines.

1237. J. H. Johnson. Lubricating. (A communication.)

1239. J. Childs. India-rubber and gutta-percha.

1245. R. V. Leach. Iron.

1262. R. V. Leach and T. W. Willett. Tin and terne plates.

1346. J. J. Lundy. Cartridges and wads.

1407. M. J. Haines. Driving straps.

1419. A. V. Newton. Fire-arms. (A communication.)

1489. E. Gwyn.. Fire-arms. (A communication.)

1683. C. Pottinger. Excavating and driving piles.

1731. W. E. Newton. Extracting oil. (A communication.)

1742. J. Davies. Ventilating apparatus.

1930. T. Richardson. Treating copper ores.

1937. J. Murray. Aërated liquids.

1951. F. Wrigley. Permanent way.

2001. W. Brown, jun., and S. Bathgate. Grinding card teeth.

2005. S. D Goff, H. Davis, S. Strangman, and E. Strangman. Drying malt.

2015. W. Neilson. Steam hammers.

2017. J. C. Nixon. Kitchen ranges.

2072. M. A. F. Mennons. Piston packing. (A communication.)

2073. M. A. F. Mennons. Hydraulic pumps. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Sept. 15, 1859.

660. I. Ash.
664. W. Avery.
671. T. W. Miller.
672. C. Defries.
676. R. A. Brooman.
678. A. G. Hutchinson.
679. P. Larochette.
681. A. Warner and W. H. Tooth.
684. W. B. Taylor.
690. R. Mushet.
691. R. Mushet.
692. A. L. Thirion.
693. C. Lambert.
694. J. W. Duncan and J. E. A. Gwynne.
696. W. B. Gingell.
700. J. W. Hart.
702. J. Howden and A. Morton.
703. R. Mushet.
707. W. Haggett.
712. J. Roberts.
713. S. Leoni.
714. J. Bickerton.
717. W. Rhodes.
727. D. L. Banks.
736. W. Adamson.
790. W. Brown.
792. J. W. Hadwen.
795. T. D. Shipman.
802. J. Lacy, S. Simpson, and H. Smith.
805. T. Ivory.
806. T. Ivory.
857. N. Libotte.
942. W. Sinnock.
1028. W. Stevenson.
1038. W. E. Newton.
1102. A. V. Newton.
1180. T. P. Bennett.
1493. A. Parkes.
1647. W. E. Newton.
1687. W. M. Smith.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2059. J. M. Hayes.
2115. S. White.
2124. P. A. Balestrini.
2143. E. Green.
2147. F. D. Monod.
2157. G. C. T. Cranstoun, G. Young, and J. Lovell.
2159. S. Chodzko.
2174. D. Crichton and J. Cathcart.
2175. J. Barber.
2200. A. Templeton.
2202. W. Young.
2203. E. Finch.
2206. J. Underwood and F. V. Burt.
2218. W. Taylor.
2253. S. Calley.
2294. J. Holman.

PATENT ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

120. G. Collier.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Sept. 16, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
365	0 3	386	2 11	399	1 4	408	0 3	417	0 3	427	0 10
367	0 7	387	0 3	400	0 6	409	1 3	418	0 4	428	0 6
370	0 4	388	0 5	401	0 6	410	0 4	419	0 8	429	0 10
372	0 7	390	0 5	402	0 3	411	0 6	420	0 3	430	0 3
376	0 7	391	0 6	403	0 3	412	1 1	421	0 5	431	0 7
378	0 7	393	0 9	404	0 10	413	0 6	423	0 3	433	0 3
379	0 5	394	0 6	405	0 3	414	0 3	424	0 5	...	...
380	3 1	397	0 3	406	0 6	415	0 3	425	0 3	...	...
383	0 6	398	0 10	407	0 3	416	0 11	426	0 11	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, Sept. 23*rd*, 1859.

		£ s. d.		£ s. d.	Dis.
IRON:					per ct.
Rails in Wales and North of England	pr. ton	6 0 0	to	0 0 0	net
Welsh Bars, in Wales	"	5 17 6	"	6 0 0	5
Staf. Bars, at the Works	"	7 0 0	"	7 10 0	2½
" Hoops	"	8 8 0	"	8 10 0	—
" Sheets, Singles	"	8 10 0	"	9 0 0	—
" Nail Rods	"	7 0 0	"	7 10 0	—
" Boiler Plates	"	8 10 0	"	9 0 0	—
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2 11 3	"	2 11 6	nett
Do. No 1, Good Brands	"	2 11 6	"	2 13 6	—
Scotch Bars	"	7 10 0	"	8 0 0	—
Swedish Bars, in London	"	11 10 0	"	12 0 0	—
COPPER:					
Sheet and Sheathing	per lb.	0 0 12	"	0 0 0	—
Tough Cake and Tile	pr. ton	107 10 0	"	0 0 0	—
Best Selected	"	110 10 0	"	0 0 0	—
Australian	"	109 0 0	"	110 0 0	—
South American	"	101 0 0	"	0 0 0	—
Yellow Metal Sheathing	per lb.	0 0 10	"	0 0 0	—
STEEL:					
Swedish Keg	pr. ton	18 10 0	"	19 0 0	2½
" Faggot	"	21 0 0	"	0 0 0	—
TIN:					
English, Block	p. cwt.	6 16 0	"	0 0 0	2½
" Bar	"	6 17 0	"	0 0 0	—
Foreign, Banca	"	7 4 0	"	0 0 0	nett
" Straits	"	7 0 0	"	0 0 0	—
TINPLATES:					
Coarse, I.C.	pr. box	1 12 0	"	1 13 0	3
Coke, I C	"	1 6 0	"	1 7 0	—
LEAD:					
Pig, English	pr. ton	22 0 0	"	22 10 0	—
" Spanish	"	21 10 0	"	22 0 0	—
Sheet	"	23 0 0	"	23 10 0	—
SPELTER:					
On the spot	"	20 10 0	"	20 15 0	nett
For arrival	"	20 15 0	"	0 0 0	—
ZINC:					
English Sheet	"	27 0 0	"	0 0 0	1½
QUICKSILVER	pr. btl.	7 0 0	"	0 0 0	1½

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, SEPTEMBER 30, 1859.

PATENT LAW REFORM.

ONE of the most unpatriotic things which a man of influence can do in this country is to originate or take part in a needless agitation. The doctrine that our society is based upon a system of compromises is no fiction of the Conservatives, but a manifest and unquestionable fact. It is by the toleration of small evils that we manage to live the peaceable lives that we in Great Britain enjoy. We cannot afford to rush to the Legislature for the suppression of every trivial wrong we see, or the correction of every little abuse which chagrins us. We are content to bear with many evils simply because the attempt to get rid of them would entail greater evils upon us.

Not only, then, do we personally deprecate all that agitation which is carried on for the mere sake of agitation, but we are also averse to every movement that is instituted on insufficient or mistaken grounds. We believe that such movements cause us incalculable harm. They do more to check the progress of useful reforms, and to evoke a spirit adverse to all reform, than any traditionary ideas or aristocratic feelings can possibly do. Statesmen who would gladly concede a proper thing, refuse almost everything because things both proper and improper are clamoured for in the same breath—the latter the more loudly of the two. Wisdom cries, but she is not heard, because folly screams so confoundingly; understanding lifts up her voice, but ignorance bawls and drowns it. We really sometimes wonder that the still small voice of reason is ever heeded, or even heard, among us.

With these feelings, we look with anxiety upon the efforts which are from time to time being made by a few individuals in reference to the reform of our Patent Laws. The Patent Law Amendment Act of 1852 was scarcely passed before attempts to get up an agitation for changing it were commenced, and these attempts have been renewed at intervals ever since. A committee has for the last year or two been appointed by a section of the British Association to inquire into and report upon the subject; and the report which that committee recently presented to the Association at Aberdeen will be found on another page of this number. It bears the signatures of W. Fairbairn, E. Sabine, and T. Webster, but, judging from its character, we can hardly believe that any one even of those gentlemen had much to do with its production. It is a clumsily drawn document, at any rate, for in its earliest sentences it tells us that the committee have done nothing decisive in furtherance of their "important objects"—although "those objects have not been lost sight of"—and that the Commissioners of Patents have made no sort of reply to the committee's memorials. These observations can scarcely give the reader any very high opinion of the committee and its labours. A committee that does nothing decisive, and gets no notice taken of what it does do, but merely congratulates itself upon not having gone to sleep and "lost sight of its "objects," is neither a very brilliant nor a very useful body, no matter under what auspices it may have organised itself, or whose names it puts to its minutes. The British Association members, however, seem to rather like that style of thing, for the meeting at which the said report was read, resolved—and resolved unanimously, too—"that the committee on the "Patent Laws be re-appointed, for the furtherance of the objects set forth in their "report."

It would be well if the members of the British Association, when they talk and resolve about the furtherance of "objects," would take some little pains to let us know, precisely and clearly, what those objects are. Unfortunately, however, they have not done so in the present instance. The report contains no definite and succinct statement of the committee's objects, but leaves us to dig them out one by one for ourselves, as best we may. They appear to be: 1, A reduction in the fees paid upon patents; 2, The application of a portion of the patent funds to the purpose of arresting the progress of some patents, with the consent of the applicants; 3, The reward of meritorious inventors who fail to profit by their inventions; 4, The application of the surplus patent funds exclusively to the advancement of science.

Now, some of these objects appear to us to require great consideration. Of course, if we are to set up some narrow class-interest as the only thing to be looked to, it will be easy enough to dispose of them. But such questions as these must be considered with a view to the public interest in general, and not to that of simple inventors, or of patentees, or of patent lawyers, or of patent agents, or of any other class. This, men like Mr. Fairbairn and his colleagues will unhesitatingly admit. Indeed, they seem so much alive to the fact that they scarcely attempt to argue their several points, lest they should put themselves into the position of partisans. We think, with them, that the fees on patents might be reduced with advantage—that, in fact, the seventh year's stamp duty of £100, which is just about beginning to fall due, might be taken off altogether. As to the first of these objects we are therefore agreed. But as to the second, we differ altogether. The proposition appears to us to amount simply to this—that a portion of the patent funds should be absorbed in paying some functionary to do that for inventors which they may be too lazy to do for themselves; or, viewed in another light, it appears to be a plan for making a few more good places under Government for dissatisfied people to get into. At the present moment every man who invents an improvement of any kind can go—thanks to Mr. Woodcroft and the Commissioners—to a Free Library and read for himself the specification of every invention ever before patented in the same branch of manufacture, and thus satisfy himself whether his idea is new or not. And this is all that a paid functionary could do for him. Why, then, should not patents be arrested by the inventors themselves, instead of being arrested by a paid officer with the inventor's *consent?* As to the committee's third object—if it can be shown how unrewarded but meritorious inventors can be easily and economically recompensed, without opening a door to any attendant abuses, we will cordially second the committee's proposal when it is properly brought forward. But as to their last object—the use of the surplus patent funds exclusively for scientific purposes—we must again differ from them. We have yet to learn why the general revenue of the country should not be contributed to by patentees, many of whom make handsome fortunes out of their patents, and all of whom hope to make a good deal more than they spend upon them.

We have thus glanced at the proposals of the committee in order to show with how little care they are conducting this agitation. The reform of our Patent Laws is a subject deserving more attention than they seem prepared to give it, and we should be glad to see them drop it altogether if they cannot bring greater zeal and intelligence to bear upon it. We want to see the law reformed in due time; but we fear the committee will hinder rather than hasten useful changes. They are injuring a good cause by loose advocacy, mixing up small and great things, and we call upon them either to resign their work or rouse themselves and set about it heartily.

It is plain that the committee are not so decidedly awake as they suppose. If they have not fallen asleep sufficiently to lose sight of their objects, they have dozed so far as to see some things in a very vague and dreamy manner. They pass over, almost silently, the grave fact that patentees are being sadly bamboozled, not to say cheated, either by the Commissioners, or by the Treasury, or by some official schemer that comes between the two. The committee tell us that one thing the Government propose to do is to build suitable offices for the Commissioners, "including a free library of consulta-"tion" for patentees upon an extensive scale. They tell us this, we say, somnolently; but they omit to tell us—indeed, they do not seem even to know—that Mr. Gladstone has put his pen through the proposal, and so rendered the thing impossible, for a year at least. But this is a matter which ought not to be passed lightly over. That library in Southampton Buildings is a disgrace to the country, and the committee might have taken the trouble to find out who it is that has induced its continuance in its present state. We strongly suspect we know the man; and if we can but thoroughly assure ourselves that we do, the mere fact of his holding half-a-dozen offices, and grasping as many salaries, will certainly not save him from the exposure which his ignorance or his superciliousness merits.

THE HOT-BLAST IRON QUESTION.

IN our articles upon the Report of the Admiralty Committee on Marine Engines, published in May last, we stated that Admiral Ramsay, Mr. Nasmyth, and Mr. Ward (who composed the Committee), recommended the entire exclusion of hot-blast iron from all future specifications for new engines, and also mentioned the opposition which the Surveyor of the Navy offered to the recommendation. We have now before us the official report of a speech made a month or two since at the Institution of Mechanical Engineers, Birmingham, by Mr. Neilson, the distinguished inventor of the hot-blast, in which speech we find a trenchant criticism of the Admiralty Committee's proceedings in connection with this matter.

It will be recollected that the experiments upon which the Committee based their recommendation were confined (so far as the Report shows) to a single pig of hot-blast and another of cold-blast iron, these being beaten by sledge hammers, and thrown upon the ground. These experiments, Mr. Neilson asserts, afforded very inadequate data for the judgment of the Committee. They were, he says, a very unsatisfactory mode of ascertaining the relative qualities of hot and cold-blast iron, and not sufficient to afford any ground whatever for so serious a conclusion: "for it was evident that the compari-"son had been made between a good cold-blast "pig and a hot-blast 'cinder pig,' which being "made of very inferior materials was far re-"moved in quality from the first class hot-blast "pig iron."

It is undoubtedly important, as Mr. Neilson says, that the mistaken views advanced in the Report should be discussed and set right, as the question is one closely affecting the ironmasters, and also the country at large; for if the quality of hot-blast iron is as good as

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that of cold-blast, and its cost only half that of the latter, a great waste would be occasioned if cold-blast iron were to be used throughout the machinery for the navy where hot-blast would answer quite as well. "Fortunately, however, "the Surveyor of the Navy's replies were "printed throughout with the Report, and were "of much value in correcting the erroneous "views advanced; and it was there pointed "out, in reply to the suggested exclusion of "hot-blast iron, that there is no ground for "prohibiting its use, simply because it is cheap "and may be improperly used; since it is un-"questionably productive of benefit when used "with judgment." This portion of the Report showed, as Mr. Neilson says, a great ignorance of practical ironmaking, the only difference recognized in the qualities of the two descriptions of iron being that due to the temperature of the blast; and, further, in the experiments witnessed, a single pig of iron only was, as we have said, dealt with in each case, and no mention was made of the locality of production, or the quality of the pig as regarded the material from which it was made.

There are three principal classes of pig iron: namely, cold-blast mine iron, in which the material used is entirely mineral or ironstone from the mine, smelted by cold blast; hot-blast mine iron, made from the same material by hot blast; and hot-blast cinder iron, made from inferior materials, and from the cinder of puddling furnaces mixed in the blast furnace. The quality of each description of iron is due almost exclusively to the materials—that is, the ironstones, fuels, and fluxes used in the furnace for its production, and varies continually even at the same works according to the nature of these materials. The ironstone varies greatly in quality, and there are altogether more than 150 different varieties now known, which are classed into the following eight principal divisions by Mr. Neilson:—

1.—*Black Band* ironstone of Scotland. This is the principal ironstone of Scotland; when smelted with cold blast it produces an inferior iron, and, indeed, as a cold-blast iron can hardly be made, since with the generally inferior fuel there obtained the necessary heat for smelting is with difficulty maintained with cold blast, and the furnaces are consequently liable to serious fluctuations in working: the cold-blast iron of Scotland is scarcely in any instance superior to the hot-blast of that country. When made by hot-blast the iron produced is of a useful quality for foundry purposes, though not very tough.

2.—*Hematite* ironstone of Cumberland; produces either with hot or cold blast a very strong tough pig, forming a good iron either for forge or melting purposes, but red short. It is very good as a toughening mixture.

3.—*Cleveland* ironstone of Yorkshire. This is a different and peculiar quality of ironstone only recently worked, but the iron made from it is now largely exported and also used extensively in this country. With hot blast it produces a serviceable but rather cold-short iron, and a fair quality for castings or forge purposes. The ironstone of this district is invariably smeltd by hot blast.

4.—*Clay Band* ironstone of Derbyshire, Staffordshire, and Shropshire; produces a good tough iron with either hot or cold blast, and when judiciously mixed in the furnace a fine quality of pig is obtained for best and general purposes.

5.—*Hydrate* ironstones of the Churnet Valley; these give a very fine soft iron with either hot or cold blast.

6.—*Northamptonshire* ironstone. At first a very inferior description of iron was obtained from this ore; but now with a better management of the furnace specially adapted to this ore, and good fuel, a very soft and fluid quality of melting iron is produced with hot blast, which compares well with the general average.

7.—*South Wales* clay band ironstone; produces fine descriptions of pig iron with either hot or cold blast. The South Wales ironworks are chiefly dependent for their iron making on the excellent quality of fuel obtained there, and the mixtures of ores used in the furnaces are largely imported from surrounding districts.

8.—*Forest of Dean* ironstone; produces with either hot or cold blast a very fine description of pig iron.

It thus appears that many of the ironstones make a good quality of iron both with hot and cold blast. The largest portion of the iron in the country—more than 90 per cent. of the whole—is now made by hot-blast; in many cases the iron is within a trifling per-centage of the same strength as cold-blast iron. The bad name at first acquired by hot-blast iron arose from not distinguishing between mine and cinder iron, and from the facility afforded by the hot-blast for making iron from very inferior materials, such as flue and tap cinder and the refuse scale of the mills and forges, which could not be worked at all by cold-blast, and of course could produce only an inferior quality of iron. The best class of cold-blast iron is no doubt somewhat superior to the best hot-blast, as a rule; but the difference is not so marked as to warrant any unqualified condemnation of hot-blast, such as is conveyed in the Report referred to, or by any means to justify its exclusion from first-class mechanical purposes, where judiciously used. Hot-blast iron, especially in second runs and for foundry purposes generally, is an excellent material when made from good ores; and the great bulk of best hot-blast castings made from judicious mixtures are quite equal to those of cold-blast iron, and at the same time much cheaper.

Such is the testimony borne by Mr. Neilson, and we think it highly desirable that it should be made as widely known as possible—not, of course, for the sake of iron manufacturers, who understand the facts of the case perfectly well, but in order to prevent engineers and others from being deceived as to the real nature of hot-blast iron.

ENGRAVING BY LIGHT.

WHEN the various photographic processes now in universal use first began to appear, the most unprophetic minds augured that other wonders were in store for us in the same direction. And they were quite right; from that time forward marvel has followed marvel with astonishing rapidity. It is only a week or two since that we inspected the photographs of Raffaelle's cartoons at the South Kensington Museum, where complete sets of varying sizes could be purchased at any price between a few pence and a few pounds! This is, of course, but one example of what is now a very common affair—the purchase of splendid photographs almost for a song. But our contemporary, the *Photographic News*—which, as a photographic organ, is unrivalled—last week presented its readers with a fine *engraving* of the Tuileries, produced by a "photo-glyphic" process which is quite unique, and deserves to be brought prominently before our readers as an illustration of the manner in which the chemical and the mechanical arts are coalescing, as well as for other reasons.

This process has proceeded from Mr. Fox Talbot, to whom we owe the discovery of the method of producing a positive picture from a negative; photography on paper; and the development of the image by gallic acid, beside other discoveries in the art, which have been crowned by this last discovery of photoglyphy. The photoglyphic process is said by our contemporary to be the only one by which a plate can be engraved without being "touched" by the professional engraver. At the present moment there is no other process known by means of which a metal plate can be engraved entirely by chemical action, and with perfect results. On the same authority it is stated that there can be no sort of question that prints from a photograph on a steel or copper plate are permanent, since they have the same guarantee of permanency as the print of our books, which has already endured in some cases for a very great number of years. Moreover, the extent to which a plate engraved by this process may be made available is almost unlimited. The plate from which the photoglyph given away by our contemporary was printed is of copper. This, after being engraved by Mr. Fox Talbot, was steel-faced. The result of this process is to give us a plate which may be used for printing any number of proofs, on the simple condition of having the steel-facing renewed as soon as the present coating of steel shows signs of wear. The picture represents a portion of the Palace of the Tuileries; and from the richness of the sculpture, the number of the statues, and the numerous fluted columns, is an exceedingly difficult subject to engrave by a chemical process, owing to the great variety of tints it presents. We may therefore point to this photoglyph with confidence as a proof of the great value of Mr. Talbot's process.

Let us now, with the aid of the *Photographic News*, glance at some of the advantages of this process. In the first place, fac-similes of rare engravings or manuscript may be multiplied by it to any extent, with the certainty that these fac-similes are not liable to fade. Again, a most important consideration in estimating the value of this discovery is the extreme comparative cheapness with which, by its means, perfectly stable photographs of paintings or other works of art may be produced. When photographs can be printed with printers' ink with the same facility as from a metal plate engraved in the ordinary manner, without the preliminary cost of engraving, there can be no reason why the most beautiful prints should not be sold at a price but little above the cost of the paper on which they are printed. And not only has this method of engraving a vast advantage over the ordinary process as regards cheapness, but it has the additional and most important advantage of giving a perfectly faithful reproduction of the scene or object without omitting the most minute details. This microscopical minuteness of delineation will render it of great value in the reproduction of anatomical photographs—a matter in which every individual may be interested. The cost of a complete set of photographs of all the various organs, &c., of the human body, taken by the ordinary process, would be so expensive as to place them beyond the reach of most medical men just commencing practice, which is the very time when they most need to keep the knowledge they have acquired fresh in their memory; but when multiplied by this mode of printing, cheapness would be secured without the slightest sacrifice of accuracy or minuteness. Further, in reproducing photographs of maps, either on a large or reduced scale, it is calculated to be of essential service. This branch of photography is practiced now to a considerable extent, but at a cost which would be very materially lessened by employing the photoglyphic process, because for all commercial purposes the reduced or enlarged photograph has to be copied by the engraver on a steel plate, which is rendered unnecessary by the process under consideration. The attention of the Government has therefore been called to this circumstance. There are excellent photographers in the Government service who are perfectly able to test the value and utility of this process, and a small portion of the sum annually expended in photographic manipulations in the different offices, would be sufficient to prove the superior advantages of the photoglyphically-engraved plate over the ordinary

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glass negative. "To sum up the advantages of "this discovery," says our contemporary, "we "may say that it gives the power of producing "an unlimited number of photographs of an "object at an exceedingly small cost, and of "undoubted permanency, whether this object "be a painting, a statue, a map, or a rare en- "graving or manuscript. It has also the addi- "tional advantage over the ordinary photogra- "phic printing process, that the picture once "on the plate the state of the weather after- "wards is a matter of no importance."

On another page we publish a detailed description of the manner in which the new art is carried out. But before leaving the question it is necessary to repeat the caution of our contemporary. The action of acids on metals has long been known, and nitric acid has been, and is, extensively employed by engravers in etching on metal plates; but this process must not be confounded with that of Mr. Talbot. In the former case a plate is coated with a substance unassailable by the acid, and the engraver etches his design on this substance, taking care that the etching needle passes through it to the surface of the plate, which is thus laid bare to the action of the nitric acid. It is manifest that, by this method, the degree of perfection of the plate so etched must depend on the excellence of the designer in the first place, and secondly, on his skill in manipulating with the acid. By Mr. Fox Talbot's process the plate is engraved without the intervention of any engraver. He himself, as he admits, has no practical knowledge of the art of engraving, and it may, therefore, be fairly considered that what he has done may be equally well accomplished by any amateur who may possess the perseverance requisite to enable him to succeed. It should be added that Mr. Talbot has wisely obtained a patent for the process, and it cannot therefore be carried out without license from him.

EMPLOYERS AND THE EMPLOYED.

RICHARD COBDEN is a great favourite with the majority of English people. His practical common-sense, his transparent honesty of character and purpose, win for him the esteem even of those who wholly disagree with him in theory; while his name, entwined with Sir Robert Peel's, will go down English history for centuries, as that of the winner of cheap bread for the English people. Mr. Cobden is a born practical administrator; and as such, is a benefactor of his country. But in the region of ideas and primary principles, he, and indeed the whole of the Manchester school of politicians, seems to us to tumble and flounder in an element wholly foreign to them. Only the other day, speaking of the relation between France and England, Mr. Cobden said, that if our armaments to protect us against France cost us six millions a-year (and he believed they cost us nearer twelve), France, as far as we are concerned, had better not be; and that if France, with an eye to England, spent six millions a-year on her armaments, England, for France's sake, had better be at the bottom of the sea. To be sure he did add, "speaking according to political "economy;" but one fails to see that this Manchester school ever thinks of men or nations but as buyers or sellers, or believes in any higher economy over them but this shabbiest, prosiest, and meanest, of Profit and Loss.

But this philosophy of life is the only one that has any vitality in the great mass of thinking heads at present. Only look at its dominion in all men say and write about the bond between employers and employed. A clever writer, commenting the other day on the strike of the London builders, surprised us with a whole series of strange assertions, but which we fear are a wide-spread creed of the present day. They are so well and outspokenly said that we devote an article here to comments on them. We refer to them only as general principles, and not at all as connected with this strike in particular.

"Determined by self-interest," says this writer, "each man has gone to this or that pursuit. "Self-interest, pure and simple, pure mere self- "advantage is the moving spring of commerce, "and is satisfied only by the highest price." Let any bright ingenuous man, occupied in any department of labour, look back to the days of his youth, and ask his own experience if this is true. As far as he can remember, was there not in him a fund of pent-up activity, eager to vent itself upon anything? And did not the calling he selected seem to his youthful wonder almost impossible and miraculous in him who practised it perfectly? Was there not an enchantment in the ingenuity that could build a house or print a page, that fascinated him? Was not enthusiasm the spring that moved him to try to imitate it? And when he first succeeded, was there not a delight that surpassed all the wages in money his work has ever brought him? And was not the "highest "price" for his labour sought in after years, more for the sake of his wife and children, or mother or sister dependent on him, than for his own? And has he never been smitten with a sense of the grandeur of the sum total of the achievements of human toil, and felt himself a member of the great commonwealth of labour, carrying on their designs higher and higher through generations? And has he never for a moment forgotten his own self-advantage in the feeling that he was doing his poor stroke of the far-reaching work, whereby all humanity is lodged, clothed, fed, cheered, and adorned? How fine is that saying of Rousseau's, of a task he left untouched in his early manhood: "One "thing that hindered me was, myself being in "question in the affair; and private interest, "whence nothing great or noble ever proceeded, "could not draw from my heart the divine "soarings which only the most pure love of "that which is just and sublime can produce."

We quote again from our text: "The com- "mands of religion and philanthropy are not to "be sought in ledgers, any more than the laws "of commerce on the walls of churches." This breaking up of human life and duty into separate parts is to dissect and destroy the man. As in his nature man is a unity, as in his person, his senses, thoughts, feelings are interwoven together, so they must be throughout the whole of his practical existence. You might as well try to separate the nervous energy of the body from digestion and the circulation of the blood, as to try to separate a man's "religion" from his "trade." When a man can put away his heart with his morning dressing-gown, and go into his counting-house with only a head and the multiplication table in it, then you may bid him be one person over his ledger and another in his church.

"Strikes," says our writer, "are good; the "natural barometers of industry; a means for "estimating the fluctuations of labour, superior "in accuracy to any other that are possible; "only divest them of the unnecessary and per- "fectly illogical bad temper which generally ac- "companies them." Most illogical, indeed! Why can't the electric fluids, seeking their disturbed equilibrium, find it again without all their pother of lightning and thunder? Why can't man and wife "strike" work, and be divorced, without bad temper? And why should workmen be ruffled when they fancy themselves wronged, and say, Not another stroke of work from us till this and that is redressed. We are not apologising for strikes. We believe them more often wrong than right. But we are trying to decipher this doctrine of political economy. And here is its main flaw. It would be quite true and practicable were men mere dead products of nature, mere articles of commerce. To deal successfully with a thing you must first study the nature of the entity you are dealing with. Timber, iron, and cotton you can deal with at your will; though even these have their likes and dislikes, their possibilities and impossibilities, which it is vain for you to neglect. How much more have you to study the temper and ways of your horse in order to manage him! But a man—with all his wants, passions, and imaginings—surely the supply and demand theory has not nicely calculated all the elements, and their intensities, contained in him. We confess that this "exclusion of all "passion, sympathy, benevolence from trade" is to us the most diabolical sentiment. How a man communicates himself to his Newfoundland dog; sports with it, shouts to it, makes a companion of it. What a friendship springs up between him and his horse. How he strokes and cheers it, and so admires it, that like Goethe, he often wishes it could speak. But the tradesman and apprentice shall stand behind the same counter all day long for years, and no friendly interest shall spring up, or friendly word be spoken!

The paper we quote from advances still farther in the same direction: "The strikers "have really struck their own case to pieces in "the very stating of it, for they assign as one "prominent reason for what they claim the "abundance of unemployed hands. But philan- "thropy cannot be brought into the question." Here, again, we speak not at all of the London builders and their workmen, but of the general principle—What have the employers to do with unemployed hands? If the supply is greater than the demand, the supply must modestly withdraw and extinguish itself. This is an upheaving of the whole foundation of society, for the men of rank, wealth, power, influence, to say to the labouring population—"We have nothing to do with finding you "work. Labour is purely a marketable com- "modity. If there is too much of it, it must "take the lot that an excess of wool or tallow "would." On what other condition are some in high places and some in low, but that those who take the high places are to guide and protect those in the lower? Surely the world is wide enough for all the men in it; and human wants are multitudinous enough to appropriate the labour of all that live. The fault is in the overseers, the generals of society, when men and labour cannot find their place. Well was it said of "the multitude" by One we profess to listen to—"They wander as sheep without a "shepherd." But our modern friend says: "It is just as rational to demand compassion "and benevolence of pure commerce as to pray "a falling tile to refrain from hitting an infirm "old woman." Happily we are quite sure trade is far from having reached this pitch. We believe there is many a noble master in England who is the friend of his men; who, if it came to that, would say to them, "Rather than pay "you wages by which you cannot live, I will pay "you more than the market price; and we will "both go to ruin together, if better wages are "to ruin us."

Whoever has eyes can see that the relation between the employers and the employed is thoroughly deranged amongst us. Everywhere the master complains of his workman, the mistress of her maidservant. The employers complain of insubordination; and those who work

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for them have their counter complaints. What is the cause? What the cure? We fear the sound of it is not within the range of the ear of political economy, else we would say, this is only one more sign of the decay of religion amongst us. The essence of religion is reverence: reverence toward every glimpse of God; in your own self, your *me*, first of all; in every phenomenon of nature and of human life; in your fellow-man, "the image of God," and supremely so in those who are your superiors. This is the golden chain that binds each to all, all to each, from the worm of the ground up to the throne of God. Now it is just this decay of reverence for what is below us, and equal to us, and superior to us in God's world, that has snapped the link between the master and his workman. The relation of these two has its foundations in nature; as much so as that of parent and child. And the workman, who has not departed from nature, will instinctively approach his employer with homage. "This man," he will say to himself, "or such as he, is set "over me by nature. He has a talent for con- "ceiving and designing, and wealth and oppor- "tunity for executing, which I have not. Com- "bined with such as he, we workmen make a "world; separated from them we make a chaos. "We are born lovers of work, and of work well "done apart from any wages it brings. We "offer our labour to him who can guide and re- "ward it. Let him be to us a human noble "master, and we will swear fealty to him. He, "and all his interests, shall be sacred to us. "Wherever our eye sees him it shall bless him. "We will honour his name at our fireside, and "our children shall honour him. Were there "need, as our ancestors did for their chiefs, we "would fight to the death for him."

And the noble masters, on their side, will care for something more than wages and hours of labour for the men. These millowners and architects will see to it that their men have dwellings fit to live in, and have sufficient there to nourish and cheer. As far as in them lies they will make men of their workmen. They will set up baths for them that they may be healthy and pure. They will give them plots of ground for recreation for themselves and their children. They will set up schools and libraries, places of amusement, places of instruction for them. Free from all condescension and patronage, as men moving amongst men, they will be frank, and courteous, and genial to their workmen, who, without servility, will revere them in return. And what reward is like that which a generous, human, noble master earns for himself? What is so sweet as the trusty, grateful, admiring homage of men? Does purer pleasure ever thrill and quiver through human nerves, than through the sea-captain's, when his sailors doff their caps and hurrah to him? or the farmer's, at the shout of his men at harvest-home? or the millowners, when on a holiday the shout of a thousand workmen greets him?

Shakespeare, who has given us models for imitation of every phase of human nature and life, has a fine sample of loyalty and devotion between servant and master in his drama of *As You Like It*. Our readers no doubt remember it, but will perhaps allow us to remind them of it here.

Old Sir Rowland de Bois is dead; Adam, his old servant, falls to the service of his eldest son, Oliver; Orlando, the younger son, is ill-used by Oliver; Orlando confides his sorrow to the old servant, and not from weakness, for he is the bravest and manliest of men. The old man admires in him the father living in the son's face: "O you memory of old Sir Rowland!" In the quarrel of the two brothers in the opening scene, Adam breaks out—"Sweet masters, "be patient; for your father's remembrance, "be at accord." Orlando resolving to leave his brother and his home, Oliver bids Adam—"Get "you with him, you old dog." *Adam:* "Is old "dog my reward? Most true, I have lost my "teeth in your service. God be with my old "master! he would not have spoke such a "word." Orlando delaying, and urged by Adam to flee, says—"What, wouldst thou have "me go and beg my food?"

"*Adam:* I have five hundred crowns,
"The thrifty hire I sav'd under your father,
"Which I did store, to be my foster-nurse,
"When service should in my old limbs lie lame,
"And unregarded age in corners thrown;
"Take that: and He that doth the ravens feed,
"Yea, providently caters for the sparrow,
"Be comfort to my age! Here is the gold;
"All this I give you; let me be your servant;
"I'll do the service of a younger man
"In all your business and necessities."

"*Orl.:* O good old man; how well in thee "appears
"The constant service of the antique world,
"When service sweat for duty, not for meed!"

Dying for food, they reach the Forest of Arden, where a duke lives "in voluntary exile, "and a many merry men with him, fleeting the "time carelessly as they did in the golden "world." Orlando, invited by the duke to sit down at his table, says:—

"Then, but forbear your food a little while,
"Whiles, like a doe, I go to find my fawn
"And give it food. There is an old, poor man,
"Who after me hath many a weary step
"Limp'd in pure love; till he be first suffic'd,
"Oppress'd with two weak evils, age and hunger,
"I will not touch a bit."

Re-enter ORLANDO, *with* ADAM.

"*Duke:* Welcome: set down your venerable "burden,
"And let him feed.
"Good old man,
"Thou art right welcome as thy master is;
"Support him by the arm."

Is this romance? Or had Shakespeare seen its like in life? Did he believe that such had been in England's olden times, and that such would be in her coming times—in her mansions, and cotton-mills, and farms?

THE GREAT SHIP'S TRIALS.

BY AN EYE-WITNESS.

(From *Once a Week.*)

THE nominal trial trip of the Great Eastern has yet to take place, but a trip full of trials has already been accomplished by her. Her strength, her speed, her steadiness, her steering capability have all been more or less tested on her passage from Deptford to Portland; and although her baptism was not one of water only, but of blood and of fire, the good ship has doubtless a career of pride and glory before her. Let me here trace, with all care, what I have seen of her perils and her successes, and augur wherein her future hopes and dangers lie.

No one at all accustomed to life on board ship could have embarked on board the Great Eastern on Tuesday, the 6th ult., without observing that her condition was by no means what he might fairly have expected to find. The most careful scrutiny could detect but few signs of organisation, and therefore but few signs of security. The passage from the ladder by which the visitor entered to the saloons in which he hoped to join his fellow-guests, lay through a portion of the ship in which combustible materials, such as shavings and planks, abounded, and in which lighted candles were freely pushed about. This was not an assuring feature in a ship about to proceed to sea. Another circumstance calculated to impress a careful person unpleasantly was that some, at least, of the "water-tight bulk-heads"—upon the integrity of which the safety of the ship might even on her first journey be made to depend—had passages left through them for convenience in moving from one compartment of the ship to another. But one conclusion could be drawn from this fact, viz., that if the bottom of the great ship should by any fatality become fairly breached in deep water, she would as infallibly go down as if she were hewn out of stone. In addition to these things one looked in vain for a sailorly ship's company. There was certainly a number of riggers on board, and with these there appeared to be mingled a slight admixture of grocers, bakers, and other unprofessional individuals, who had taken upon themselves for the moment, apparently, the functions of mariners. But I must confess their presence inspired me with exceedingly little confidence. Fortunately, however—or was it unfortunately?—there was but little need for sailors, seeing that the ship had not a single sail bent, even to serve a turn upon an emergency! She was furnished, it is true, with two sets of engines, and two propelling apparatuses, so that should any derangement occur to one she would still have another to rely upon. But both engines were new, and both might fail without any miracle; and I should have been better satisfied to have seen that her yards bore canvas. In the captain of the ship I had full reliance; the pilot who was to navigate her was a man of long-tried ability; the immediate control of both the paddle-wheels and the screw was in the hands of the best man for the purpose—Mr. Scott Russell.* In these respects nothing more could be desired. But at the same time it appeared that these gentlemen themselves were in the hands of commercial men by whom their professional desires were over-ridden, or the journey to Portland would not have been undertaken until the ship had attained greater completeness. If this were not so, then Captain Harrison, though he may be a splendid navigator, is an indifferent disciplinarian.

In the passage of the ship to Purfleet on the first day and to the Nore on the next, there was but little that needs remark here. . . . . There were, however, a few things which an intelligent eye-witness cannot have omitted to note. The first was the application of steam-power to the rudder. This occurred, in the first instance, before the ship left Deptford. Mr. Lungley, whose steering-signal apparatus is fitted to the ship—and answers well—desired to have the rudder worked from side to side for a time. This there were not hands enough on the spot to effect. Then it was that Mr. Prowse, the intelligent second officer of the ship, led a rope from the engine of the steam crane to the tiller, and by that means worked the rudder with the utmost ease and facility. This device, noted at the time, was again resorted to off Beachy Head with great advantage, as will hereafter be mentioned. Another notable circumstance was the application of steam-power to the weighing of the anchor. This was resorted to both at Purfleet and the Nore, and without it I see not how the anchor could have been weighed at all by the few seamen on board. A third thing noted was the excessive delivery of cable at the Nore. Twice after the ship was anchored to the satisfaction of the pilot was fathom after fathom of cable allowed to run out, contrary to his instructions, and much to his annoyance. This is mentioned merely as one example of the errors committed, not to say the risks run, from the want of discipline and efficiency of the men on board the ship.

* The proceedings which have taken place at Weymouth, since this article was penned, render it necessary for me to remind the reader that this remark, like another of similar purport which occurs later in the article, implies only that Mr. Scott Russell had the working of the captain's telegraphs to the engine-rooms committed to him, in order that no mistaken instructions might be transmitted to the engine-drivers below. This duty, which was voluntarily undertaken by Mr. Russell, necessarily absorbed the whole of his attention, and was performed to the perfect satisfaction of the pilot and the captain.—E. J. R.

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After the weighing of the anchor at the Nore, at seven o'clock on Friday morning, the Great Eastern started, under her own steam, and without the attendance of tugs, on her trip to Portland. From that time until six in the evening the company enjoyed one prolonged display of her great and noble qualities. We had a high wind and a heavily-rolling sea for many hours in succession. All other vessels—and we passed hundreds—either tossed and pitched at anchor with the greatest violence, or ran before the gale under close-reefed sails. But, despite the driving wind and yawning sea of the Channel, our "moving isle" went as steadily forward as if she had still been stealing her silent way down the unruffled waters of the Thames. It was only by the most careful watching that any eye could detect even the slightest motion in her. The ponderous paddle-engines worked as smoothly as the machinery of a lady's watch, and the screw-engines, although less perfect, require nothing but kindly mention here. Her speed, moreover, was all that could be desired, and more than could have been expected, for, with her engines working at but half-speed, she advanced at more than twelve knots an hour against the beating head-wind. No wonder, then, that every man on board congratulated his fellow on that triumph of human genius over matter in which all were participating.

But at 6-10 P.M., in a moment, in the twinkling of an eye, all congratulations (of that kind) were brought to an end. A report as of a huge but lightly-rammed piece of ordnance—a heavy throb of the deck beneath our feet—the upheaval of the massive foremost funnel—the bursting forth of a thick dense cloud of steam—the descent of a shower of shattered glass and saloon finery—all these, followed by cries and groans never to be forgotten, turned the joy of all into mourning. But the mourning that thus fell in a moment upon the officers, men, and passengers of the Great Eastern at that terrible crisis brought no idle, whining, complaining spirit with it, but a spirit of active aid and beneficence. The rescue of the unfortunate men in the stoke-hole, upon whom a horrible deluge of steam and fire had descended, and the preservation of the ship from the fire that seemed to threaten her, were the first duties to which all applied themselves. Or, if not all, all but here and there a man whom the horror of the scene had overcome. There were a few such, and but a few.

With the "water-tight bulkheads" (so-called) in the state before described, had the bottom of the ship been blown out—or, which is much more probable, had masses of the shattered funnel been "fired" through the bottom (after the fashion of shot from cannon)—nothing but the pumps could have saved the magnificent ship from foundering. Whether the pumps would have been equal to the occasion or not it is impossible to say. The event unquestionably teaches that such a ship should never be sent to sea at all until all that it is proposed to do to make her safe has been done. The precautions against fire—at that portion of the ship, at least—appeared to be ample. On the alarm of fire coming up from below, Captain Harrison and Mr. Scott Russell promptly brought the hoses into play, and the supply of water forced through them by the engines was abundant.

I have already stated that the ship had not a sail bent, and have also remarked that in the event of an emergency Mr. Prowse knew how to steer the ship by steam. Both of these facts assumed importance soon after the explosion. About noon I had discovered that the steering wheel ropes—which were of hemp, and not of hide as they should have been—were being rapidly cut through by the iron sheaves round which they passed. A preventer should have been at once got on, and new ropes rove. Whether these things were done or not, I cannot say. But as we were nearing Beachy Head in the evening, and as a vessel (not seen by me) is said to have been bearing down awkwardly upon us, our wheel-ropes gave way. Strange to say, the paddle-wheel engine was just then either stopped or very greatly reduced in speed without the directions of Mr. Russell, who had charge of them; and, to complete the troubles of the moment, the screw engines, which had long been a little uneasy, began to groan very audibly. When the ropes went, the ship fell off the wind, turning herself directly upon Beachy Head, and for the first time acquired a very sensible motion. By clapping a rope from the steam crane upon the tiller, command of the helm was speedily attained, and the momentary failures all came to nothing. But they, nevertheless, sufficed to show how very desirable it is that even the Great Eastern should not be taken to sea, as I have said, imperfectly equipped. Had both engines failed on this occasion, as they seemed disposed to fail, or had the inferior wheel-ropes not been supplemented by an extraordinary device, we must either have gone ashore on a lee coast, or trusted to Mr. Trotman's anchors to keep us off it.

The remainder of the trip to Portland was all that could be desired. Nobly the great ship held on her course down Channel through the succeeding night, over the silver sea, and "under the silver moon." Nobly she came to anchor next morning within Mr. Coode's costly breakwater at Portland. How gladly would we have thronged her high sides, and echoed the cheers of the thousands of welcoming visitors who came to greet us, but for those who below were suffering, and those who had been released from suffering!—but for the destiny which had made our city of the sea a city of the dying and the dead!

The accident which has happened to the Great Eastern in no way interferes with the general question of her ultimate success. For the moment it may depress her interests, but the reaction will inevitably follow, and the ship will be estimated according to her own merits.

* * * * * *

The Great Eastern must, however, be fairly dealt with. Let her not be trifled with. Let her water-tight bulkheads be made water-tight; let her yards have sails bent upon them; let her captain have a crew to handle her at his will; let her wheel-lines, and all other parts of her equipment, be of the right material; let her machinery be placed under the care of a sufficiently-large and well-organised staff of engineers; let, in short, the ideas of her designers and builders be faithfully carried out in all respects, and then commercial success will be secured. It will be easy enough for the directors to persuade themselves that many of these things may be deferred, and the ship taken from this place to that, and from that to another, in her present imperfect condition. But public confidence is the indispensable basis of commercial success, and public confidence cannot possibly be gained while the ship is in her present state.

It would not, perhaps, be requiring too much should we ask for the ship now to be delivered up to the captain, and for the directors and their friends to become his guests, and therefore subject to his wishes. The Great Eastern is no longer a mere commercial man's hobby, or a Londoners' exhibition; she is a ship, and henceforth must be managed and commanded as a ship should be. Until this is done no good can come of her.

E. J. REED.

REFORM IN THE PATENT LAWS.

IN Section G of the British Association at Aberdeen, the following Report of the Committee on the Patent Laws was read:—

At the meeting of the British Association at Leeds for the year 1858, a committee was re-appointed for the purpose of taking such steps as may be necessary to render the Patent System of this country, and the funds derived from inventors, more efficient and available for the reward of meritorious inventors and the advancement of science.

Circumstances beyond control have prevented that committee from taking any decisive steps in furtherance of the important objects entrusted to them; but those objects have not been lost sight of. No reply has been received from the Commissioners of Patents, either to the memorial of the Glasgow Committee of the British Association, or of the public meeting in Manchester; but some of the questions referred to in those memorials are adverted to in the Report of the Commissioners just issued. From that Report it appears that the number of applications for Patents may be estimated at about 3,000 per annum—that of these 3,000 applications, not more than about two thousand proceed to the final stage of a Patent; and that of the two thousand Patents granted not more than 550 are kept alive beyond three years by the first periodical payment of £50 before the expiration of that term; and the Commissioners anticipate that the fee of £100, payable at the end of the 7th year, will not be paid on more than 100 of the surviving 550 patents. Should this anticipation prove correct, the payment by inventors in fees upon patents not surviving beyond one-half their term of 14 years, will not be less than at the rate of £100,000 per annum, as a direct tax on the inventive genius of the country in addition to, and exclusive of time, labour, and other charges and expenses. The total outlay in respect of those patents may be estimated as at least £250,000, or a quarter of a million per annum. The great work of printing and publishing *in extenso* the Specifications of Patents, granted under the old law—that is, from 1,711 to the 1st October, 1852, in number 12,977—is completed, and the surplus funds hitherto absorbed by this object will be henceforth available for other purposes. That surplus is estimated by the Commissioners at £30,000 for the current year, 1858-9, and to increase in each succeeding year at the rate of £20,000 per annum. This surplus, after providing for the current expenses, is proposed by the Commissioners to be appropriated to the following objects:—

1. The erection of a museum for the preservation and exhibition of models, of which a considerable collection already exists at Kensington.

2. The erection of suitable offices for the Commissioners, including a free library of consultation, upon a more extended scale than already formed by Mr. Woodcroft.

These most desirable and legitimate objects for the application of the "Inventors' Fee Fund," cannot, however, be attained without the sanction of the Lords Commissioners of Her Majesty's Treasury and a vote of Parliament, inasmuch as all the fees levied on inventors are, by a recent change, levied in the shape of stamps, and so pass directly into the Consolidated Fund. These recommendations of the Commissioners will, it is conceived, be regarded as a most legitimate application of the funds of inventors, and as one to which the Parliamentary Committee of the British Association will give their aid, but your committee think that other considerations, and other claims upon the Inventors' Fee Fund, and upon the annual surplus, whatever its probable amount, should be forthwith urged upon the Commissioners and upon Parliament.

The report of the Patent Committee of the British Association to the Leeds meeting called prominent attention to the two following questions:—

1st. Whether the present scale of payment would be maintained or reduced so as to leave no greater surplus than necessary for official expenses?

2nd. If the present scale of payment be maintained, how shall the surplus be appropriated?

The Commissioners of Patents are in favour of maintaining the present scale of payments, on the ground "that any material reduction in the amount of fees would undoubtedly tend to increase the number of useless and speculative patents, in many cases taken merely for advertising purposes."

Your committee are not insensible to the force of this observation, but they beg respectfully to doubt whether this money check has any effective operation on the class of cases most requiring to be controlled, and whether the remedy is not worse than the disease in laying an unjustifiable burden on the inventive genius of the country, and

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effecting confiscation of property of its own creation.

Your committee are much struck with the fact that the application for about 1,000 patents is not prosecuted to completion, and in many cases probably not beyond the first stage; and that the first periodical payment of £50 at the end of the third year is not made in respect of nearly 1,500 of the 2,000 patents granted; and that the Commissioners anticipated during the ensuing year the surrender or lapsing of no less than 450 out of the 550 patents which survived the first periodical payment.

It must be borne in mind that the granting of patents in this country is practically without control, no attempt having been made to interpose any of the checks urged before the Committee of the House of Lords, in the session of 1851, and provided for in the three Bills of that session, and in the leet of the subsequent session, now the law of the land. The payment of £5 on the first application may be regarded as a registration fee; the applicant makes this payment on lodging the papers, obtaining protection and inchoate rights from the moment of his application. This was one of the cardinal features of the new system of 1852. It has been productive of the greatest benefit to invention, especially to those of the poorer class, by enabling them to obtain inchoate rights, and to create property for themselves by a simple record of their inventions without publicity and the obstruction of interested opponents. This power of placing inventions on record is also resorted to in many cases by those who do not wish further to secure or appropriate to themselves property in their ideas and inventions, which forthwith become public property. The 1,500 lapsed patents must be regarded in a different light. These have cost their authors no less than £37,500 for fees and stamps as a direct taxation on their inventive genius, in addition to, and exclusive of, other payments of at least an equal amount. Of these 1,500 patents it is believed that the progress of at least 1,000 might be arrested with the *consent* of the applicants if the inquiry before the law-officers were substantial instead of merely nominal. Thus a large useless outlay of capital in money and time would be avoided—talents unprofitably employed would be directed into other channels, and the creation of legal rights would be limited and reduced, exactly in proportion as the applications were not proceeded with.

Your committee conceive that the application of a portion of the funds contributed by inventors would be most properly applied to affording them this species of protection against the unprofitable expenditure of time and money; the attempt is surely worth the trial; it would effectually check the prostitution of the patent system to the illegitimate purposes referred to by the Commissioners.

The reward of the meritorious inventor, in cases in which he alone of the public has failed to benefit by the fruits of his genius and the purchase of patent rights in him of extending their terms, was referred to in the Report of the Patent Committee of the British Association at the Leeds meeting, as a legitimate appropriation of a portion of the surplus.

These objects being satisfied, a very large surplus would remain available for the advancement of science, by researches having a direct bearing on the reproductive industry of the country. And if it be thought expedient that more money should be levied on the granting of patents than necessary for the expense of the office, inventors have, it is conceived, an irresistible claim for the expenditure of that surplus upon objects bearing on their interest and the advancement of science.

W. FAIRBAIRN.
EDWARD SABINE.
Aberdeen, 16th Sept., 1859. THOMAS WEBSTER.

A new yacht, called the "Light of the River," built of steel plates, for Ismail Pacha, of Egypt, by Messrs. George Forrester and Co., of Liverpool, sailed from that port on Wednesday for Alexandria.

THEORY OF NAVAL ARCHITECTURE.

No. IX.

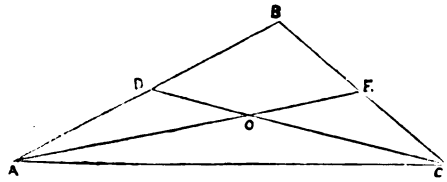
CONTINUING our explanation of the table given on page 299, Vol. I., we observe, that in order to complete the scale of displacement above the load water line, it is assumed that the area of all sections parallel to that of the load water line throughout a depth of one foot is the same as that of the load water section; consequently the solid content of a zone, the base of which is the load water section, and depth one foot, is found, as shown at the bottom of the table to the extreme right, and the weight of an equal volume of sea water. A vertical line $a\,b$ is then drawn through the point where the scale of displacement meets the load water line, and made equal to one foot on the proper scale for draught of water; a level line $b\,c$ is drawn through b; $b\,c$ is then made equal to the representative of the number of tons of sea-water in the zone, and the points a and c are joined. The line $a\,c$ is a tangent to the curve at the load water line, and when continued above it, is taken as part of the scale of displacement.

The displacements per inch immersion at all the other water lines have been calculated in the same manner as for the load water line, and are given in the table in their respective columns; tangents to the curve may therefore be drawn at all the water lines, thus forming guides at a number of points for the proper delineation of the scale. We have now explained everything on the table referring to the *displacement* of our example, and shown how it may be found at any draught of water; it remains for us to describe how the centre of gravity of displacement is found, it being necessary that this point should be situated in the same vertical line as the centre of gravity of the ship, in order to fulfil the fundamental conditions of the equilibrium of a floating body.

To find this point we must show how the centre of gravity of any number of bodies rigidly connected is found. And to commence with the simplest cases with which we have to do in questions relative to Naval Architecture, let us find the centre of gravity of a parallelogram.

Bisect all the sides, and join the points of bisection of the opposite sides, the point in which these lines intersect is the centre of gravity of the parallelogram. This will be readily followed without the aid of a figure.

FIG. 16.

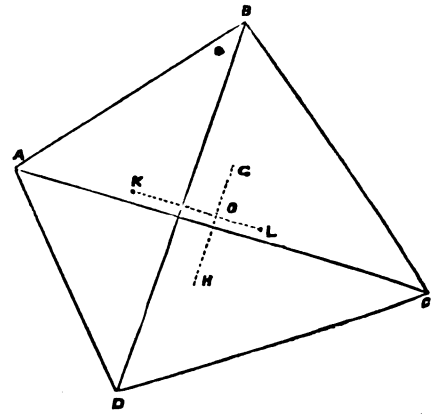


To find the centre of gravity of the triangle $A\,B\,C$, Fig. 16. Bisect the sides $A\,B$ and $B\,C$ in D and E respectively, join $C\,D$ and $A\,E$; the point O in which these lines intersect is the centre of gravity of the triangle. For if we suppose the triangle to be made up of very small slices all parallel to $B\,C$, each slice will balance in all positions about $A\,E$, since $A\,E$ would bisect it: consequently the whole triangle would balance in all positions about $A\,E$. In the same manner it will be seen that the whole triangle will balance in all positions about $C\,D$: it follows, therefore, that O, the point of intersection of $A\,E$ and $D\,C$, is the centre of gravity of the triangle.

To find the centre of gravity of the trapezium $A\,B\,C\,D$, Fig. 17.

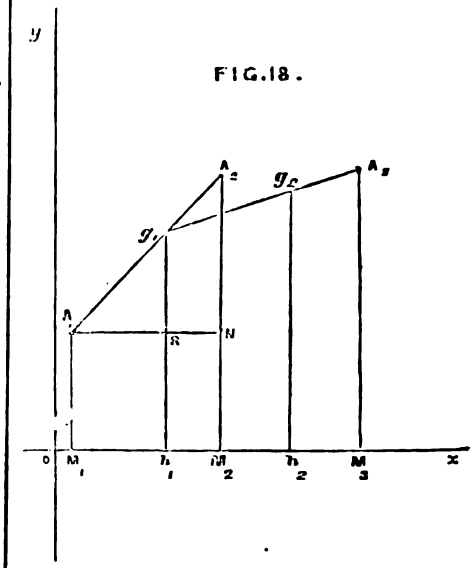
Divide the trapezium into the two triangles $A\,B\,C$ and $A\,D\,C$ by the line $A\,C$: find, by the construction above given, the centres of gravity G and H of the triangles $A\,B\,C$ and $A\,D\,C$ respectively, join $G\,H$; the centre of gravity of the whole trapezium lies in $G\,H$. Again, divide the trapezium into the two triangles $D\,A\,B$, and $D\,C\,B$ by the line $D\,B$: find their centres of gravity K and L respectively; join $K\,L$, then the centre of gravity of the trapezium is in $K\,L$; but it is also in the line $G\,H$, it is therefore in O, the point of intersection of $G\,H$ and $K\,L$.

FIG. 17.



To come, however, to the general case of finding the centre of gravity of any number of bodies which are rigidly connected, let us first take the case in which the centres of gravity of all the bodies lie in the same plane.

FIG. 18.



Let A_1, A_2, A_3, &c., ... A_n, Fig. 18, be the respective centres of gravity, situated in the same plane, of the bodies whose weights are P_1, P_2, P_3, &c., and P_n. Join A_1 and A_2, and take the point g_1 in it such that $P_1 \times A_1 g_1 = P_2 \times g_1 A_2$.

Again, join g_1 and A_3, and take g_2 in it such that $(P_1 + P_2) \times g_1 g_2 = P_3 \times g_2 A_3$.

Then g_1 is the centre of gravity of P_1 and P_2; for if g_1 be supported there will be equilibrium in whatever position the bodies are placed: g_2 is also the centre of gravity of P_1, P_2, and P_3; and the same mode of construction can be used until the centre of gravity of all the bodies is found.

Take any point O in the plane through A_1, A_2, &c., and through it draw the straight lines Ox and Oy at right angles to each other.

Let perpendiculars A_1M_1, A_2M_2, A_3M_3, &c., g_1h_1, g_2h_2, &c., be drawn from the bodies, and from g_1, g_2, &c., upon the line Ox, and let the former be represented respectively by y_1, y_2, y_3, &c., and let Y represent the perpendicular from the centre of gravity of the system upon the line Ox.

Through A_1 draw A_1RN parallel to Ox, cutting g_1h_1 in R, and A_2M_2 in N; and

Since $P_1 \times A_1 g_1 = P_2 \times g_1 A_2$ by construction then by addition

$$P_1 \times A_1 g_1 + P_2 A_1 g_1 = P_2 \times g_1 A_2 + P_2 \times A_1 g_1,$$
$$= P_2 \times A_1 A_2;$$

or, $$(P_1 + P_2) \times A_1 g_1 = P_2 \times A_1 A_2;$$

$$\therefore \frac{A_1 g_1}{A_1 A_2} = \frac{P_2}{P_1 + P_2};$$

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Also by similar triangles

$$g_1R = A_2N \times \frac{A_1g_1}{A_1A_2} = (y_2 - y_1) \cdot \frac{P_2}{P_1 + P_2};$$

or, $$(P_1 + P_2)g_1R = P_2y_2 - P_2y_1;$$

also, by addition,

$$(P_1 + P_2)(g_1R + Rh_1) = P_2y_2 - P_2y_1 + P_1y_1 + P_2y_1;$$

or, $$(P_1 + P_2)g_1h_1 = P_1y_1 + P_2y_2.$$

Similarly,

$$(P_1 + P_2 + P_3)g_2h_2 = P_1y_1 + P_2y_2 + P_3y_3;$$

&c. = &c.;

and finally,

$$(P_1 + P_2 + P_3 + \&c.... + P_n)\,Y = P_1y_1 + P_2y_2 + P_3y_3 + \&c..... + P_ny_n.$$

Therefore, by division,

$$Y = \frac{P_1y_1 + P_2y_2 + P_3y_3 + \&c..... + P_ny_n}{P_1 + P_2 + P_3 + \&c..... + P_n}.$$

Or, the distance of the common centre of gravity of any system of heavy bodies, whose centres of gravity are situated in one plane, from any line in that plane, is equal to the sum of the products of the weights of the bodies and their respective distances from the same line, divided by the sum of the weights of the bodies.

In like manner it may be shown, if X represent the distance of the centre of gravity of the system from the line Oy, and x_1, x_2, x_3, &c, the perpendicular distances of A_1, A_2, A_3, &c., from Oy, that

$$X = \frac{P_1x_1 + P_2x_2 + P_3x_3 + \&c..... + P_nx_n}{P_1 + P_2 + P_3 + \&c..... + P_n}.$$

When, therefore, Y and X are determined from these two equations, the position of G, the centre of gravity of the system is known.

It may be easily proved that wherever we place the lines Ox, Oy, the position of the centre of gravity G will be found to be invariable, as would, of course, be expected. If the lines be placed so that some of the bodies be on one side of Ox or Oy and the remainder on the other side, then the distances on one side must be considered positive and those on the other side negative, and collecting the products of the weights and distances, those on the latter side must be subtracted from those on the former.

Again, if the lines Ox and Oy pass through one or more of the bodies, as Ox through A_1 and Oy through A_2; then the distances y_1 and x_2 vanish, and we have

$$Y = \frac{0 + P_2y_2 + P_3y_3 + \&c. ..... + P_ny_n}{P_1 + P_2 + P_3 + \&c. ..... + P_n};$$

$$X = \frac{P_1x_1 + 0 + P_3x_3 + P_4x_4 + \&c.... + P_nx_n}{P_1 + P_2 + P_3 + P_4 + \&c.... + P_n}.$$

When the centres of gravity of the bodies do not lie in one plane; if three planes be taken at right angles to each other, and perpendiculars x_1, x_2, x_3, &c. ... x_n, y_1, y_2 y_3, y_4, &c. ... y_n, and z_1, z_2, z_3, &c.... z_n, be drawn from the bodies, and X, Y, and Z from the centre of gravity of the whole system upon the three planes respectively, it can be shown by constructions similar to what we have given above that

$$X = \frac{P_1x_1 + P_2x_2 + P_3x_3 + \&c. .....+P_nx_n}{P_1 + P_2 + P_3 + \&c.....+P_n};$$

$$Y = \frac{P_1y_1 + P_2y_2 + P_3y_3 + \&c.....+P_ny_n}{P_1 + P_2 + P_3 + \&c.....+P_n};$$

and $$Z = \frac{P_1z_1 + P_2z_2 + P_3z_3 + \&c.....+P_nz_n}{P_1 + P_2 + P_3 + \&c.....+P_n}.$$

Having obtained the values of X, Y, and Z from the above equations, the position of the centre of gravity of the system is known.

To return, however, to the consideration of the centre of gravity of the displacement of a ship. Since all ships are symmetrical with respect to a vertical longitudinal plane passing through the middle line, it is evident that the point sought must be situated in that plane; we have then at present only to find its position in a fore and aft direction.

For this purpose let us assume that the part of the ship under water is cut up into very thin slices by transverse vertical planes, as represented in Fig. 5, page 56, vol. i., our object now will be to find the sum of the products of the weights of all these slices, and their respective distances from any transverse vertical plane: since this sum divided by the total displacement will give the distance of the common centre of gravity from the same plane.

Now the weight of any thin slice is equal to the area of its section multiplied by its very small thickness (if we take the weight of an unit of volume as unity), and the product of the weight and its distance from any transverse vertical plane is equal to the area of the section multiplied by its distance from that plane, and again by the very small thickness of the slice.

Take, therefore, a line of abscissæ equal to the entire length of the ship, and having found the areas of all the equidistant transverse vertical sections, already made use of in finding the displacement, multiply them respectively by their distances from the foremost section, for example, and draw ordinates at the several sections, making them equal to the numerical values of the respective products; draw a curve through their extremities, similar to that drawn in dotted lines in the figure above mentioned, and the enclosed curvilinear area will represent the sum of the products of the weights of all the slices and their respective distances from the foremost section; the numerical value of this area divided by the displacement, will give the distance of the centre of buoyancy from the foremost section.

In making the calculations, however, on our table, it is more convenient to divide the distances from the foremost section by the common interval, and after the sum of the products has been obtained, to multiply it by that number.

Referring, therefore, to our table, (page 299) it will be observed that the third column under *Vertical Sections*, contains the quotients of the distances of the transverse sections respectively, from the foremost section divided by the common interval: as 0, ½, 1, 1½, 2, &c. The numbers in the vertical column headed *Multiples of Areas*, when multiplied respectively by these numbers opposite to them, are inserted to the right in the column headed *Moments*, and represent the relative products of the weights of very thin slices at the several transverse sections, and their distances from the foremost section; their sum, in the present case equal to 11689·05, when multiplied by 12·6, the common interval, and divided by 1832·0, the sum of the column, *Multiples of Areas*, will give the distance, 80·39 feet, of the centre of buoyancy from the foremost section.

It will be seen that the calculations have here been abridged; since to obtain the actual weights, and the products of the weights and their distances from the foremost section, the sums of those two vertical columns should each have been further multiplied by ·5, 4·2, and 2; this is, however, unnecessary for our purpose.

We have now completed our description of the calculations on our table, referring to the fundamental conditions of the equilibrium of a floating body; and these must hold whether the vessel swims uprightly of herself, or whether she is merely kept upright by some horizontal forces. Ships, however, must not only be able to stand up of themselves, but must be indued with power to resist inclination when acted upon by external forces: this power of resisting inclination, termed "*moment of stability*," depends, *cæteris paribus*, upon the relative position of the centre of buoyancy, in a vertical direction, and the *Metacentre*.

To find the centre of buoyancy in a vertical direction the same process is gone through as that described for obtaining its position in a fore and aft direction; and the plane from which the distances are measured is that of the load water line. In the table, page 299, let the horizontal column (corresponding to the vertical column headed *Multiples of Areas*) that is, 1·8, 110·4, 103·95, 283·0, 257·1, 838·8, and 236·95, be multiplied by 4, 3½, 3, 2½, 2, 1, and zero respectively, and the results inserted under them; the sum, amounting to 2765·95, multiplied by 1·5, the common interval between the horizontal sections, gives for result 4148·925; this quantity divided by 1832·0 will give 2·264 feet for the distance of the centre of buoyancy below the load water section: the rationale of these operations will be readily made out from what has been explained for obtaining the position of the centre of buoyancy in a fore and aft direction. In order to complete our table of calculations we shall give the rule for finding the position of the *Metacentre*, leaving the investigation of it u we come to deal with the question of stability in a general way.

Rule to find the height of the *Metacentre* above the centre of buoyancy.

Take the middle line of the load water section as before as the axis of abscissæ, and at the intersections of the several vertical sections let ordinates be drawn, the numerical values of which are the cubes of the respective half breadths of the ship at the load water section; find the curvilinear area thus formed, take two-thirds of the result, and divide by the displacement in cubic feet; the quotient will give the height of the *Metacentre* above the centre of buoyancy.

The calculations given in the last two vertical columns of our table, page 299, headed *Metacentre*, will be readily made out. Thus, the numbers in the first column, headed cubes, are the cubes of the respective semi-ordinates of the load water line; ·73 is the cube of ·9 nearly; 6·86 of 1·9, &c.; and the second column gives these cubes multiplied by the numbers for finding a curvilinear area; the sum of the latter quantities, or 16703·58, multiplied by 4·2 (one-third the common interval between the vertical sections) gives the curvilinear area 70155·036: two-thirds of this divided by 7691·4, the displacement in cubic feet, gives 6·0784 feet for the height of the *Metacentre* above the centre of buoyancy.

We have now completed the description of our table of calculations, and elaborately shown how the displacement, &c., of a ship may be found when she floats on an even keel, in which case, the extreme horizontal and vertical sections enclose all the displacement except such as may be safely neglected.

Ships are, however, more usually constructed to "sit by the stern," or, to draw more water abaft than forward; in our next article we shall give an example of such a construction; and the student will then be enabled to perform the necessary calculations relating to any design with which he would have to do.

THE COMPASSES OF IRON SHIPS:

BEING A "REPORT ON CHANGES OF DEVIATION OF THE COMPASS ON BOARD OF IRON SHIPS BY 'HEELING,' WITH EXPERIMENTS ON BOARD THE CITY OF BALTIMORE, APHRODITE, SIMLA, AND SLEEVE DONARD," BY MR. JOHN T. TOWSON.*

THE author explained the manner in which the compass committee was first formed, in accordance with the advice of the section he was then addressing, and that two reports had been drawn up, which, with the advice of the Astronomer Royal, had been printed and "presented to both Houses of Parliament by command of Her Majesty." He thanked the Astronomer Royal for his valuable advice and support. There were matters of consideration which the compass committee deemed incomplete; the one was the change which took place in iron ships in proceeding to the opposite hemisphere; the other, the change that was produced by what is technically denominated *heeling*, that is, when the deck of a vessel leaned over through the action of the wind or otherwise; if when looking towards the bow it slanted downwards to the right, it is said to heel starboard, if to the left, to heel port. The first question was undertaken by the late respected Rev. Dr. Scoresby, who proceeded to Australia in the Royal Charter, and whose exertions in the pursuit of this branch of the inquiry shortened a most valuable life. The second question was the sub-

* British Association, Section A., 1859. *Athenæum.*

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ject of his (Mr. Towson's) present report. Having described the principles on which his graphic illustration was constructed, he pointed out the unexpected amount of deviation which this source of disturbance (heeling) brought about, amounting in most instances, when the ship's head was in the position to produce the maximum effect, to two or three points in the standard compass, and after to a greater amount as far as the steering compass is concerned. He remarked on several particulars connected with this investigation. Generally the north end of the compass was drawn to the upper side of the ship—the case with seven out of nine compasses on board the City of Baltimore, but in the two steering compasses the needles were drawn in a contrary direction. Mr. Towson explained the theory on which this disturbance arose, partly from subpolar magnetism below the compass, and partly from the disturbance of the inductive magnetism of the ships. In such ships as those under consideration, the following empirical rule held good with respect to compasses favourably placed. When the vertical force as determined either by vibrating experiments or torsion on board the ship maintained the ratio, as compared with the vertical force on shore, in the proportion of nine to fourteen, little or no effect was produced by heeling; and in the case of the Simla this plan of predicting the amount of error was adopted: a moveable upright magnet was applied so as to produce the before-named vertical force, when it was found "with magnet in" no error was produced, although "with magnet out" it amounted to 24° from changing a heel of 10° starboard to 10° port. Another remarkable result appears to exist. He believed that when a ship was built with her head south-east or south-west, little if any effect would be produced by heeling. When examining the magnetic condition of the Sleeve Donard, they were surprised to find that the vertical was very nearly that which would give no effect from heeling. Their talented stipendiary secretary (to whom is due the credit of drawing up the two reports already published) immediately suggested that her head could not have been east when building, which we had taken for granted; and on inquiry we found that on account of her great length she had been built diagonally, with her head south-east nearly. Although Mr. Towson believed that for practical purposes sufficient information had been obtained, yet there were anomalies in their observations that rendered the theories deduced unsatisfactory. This he believed arose from the rapidity with which they were obliged to carry on their experiments, on account of the passing in and out of ships through the docks, from which cause the inductive influence of the earth had not sufficient time to complete its effect. It had been proposed to request the aid of the Admiralty in allowing the Committee to experiment on one of Her Majesty's iron ships in some convenient place for an unlimited time. In conclusion he requested that the Astronomer Royal would favour the Society with his remarks.

The PRESIDENT (the Earl of Rosse) remarked, that he himself had made some observations on the deviation of the compass on board an iron ship which he possessed. After trying magnetic compensation, the magnets were taken away, and a table of errors adopted. He believed that magnetic compensation rendered the compass sluggish. —The ASTRONOMER ROYAL, in reply to the noble President, stated that the magnetic adjustment rendered the directive force exercised on the needle equal, with the ship's head on all points of the compass. Without compensation, with the ship's head on some point, the directive force was frequently neutralized by the ship's magnetic force. He complimented the compass committee for their labours, and the judgment exercised in carrying out their experiments, and he especially referred to the services of Messrs. Rundell and Towson: the former was now carrying out these experiments on board the Great Eastern. He had been prepared to find that the compasses on board iron ships were affected by heeling, but was surprised at the amount, yet convinced of the practicability of compensating this source of error. He considered that the compass committee should not conclude their labours without further experiments, and thought that the Admiralty should place an iron ship at their disposal.—ADMIRAL FITZROY availed himself of this opportunity of bearing his testimony to the value of the services of the Astronomer Royal. Notwithstanding his great exertions in the pursuit of science in various departments, he believed his great work was his labours in connexion with iron ships.—PROFESSOR W. THOMSON wished, so far as his opinion could have any weight, to recommend that the necessity for constant determinations of the error of the compass should be enforced on masters of ships generally, but most strongly on all masters of iron ships. It appeared to him that the only way to use the compass safely *is never to trust to it*, that is to say, to take azimuths astronomically as often as weather permits, and only to use the compass as a convenience for steering by according to these azimuths, and as a means of keeping as nearly as possible the desired course in the intervals between the azimuthal determinations. When these intervals amount, as they often do, to several days or weeks, no confidence ought to be felt in the dead reckoning within a wide margin of possible error in the course, and the established precautions on approaching those ought to include a large allowance for this uncertainty. No such security can possibly be had for the determination of direction by the compass as the comparison of two or three or more chronometers always gives, in a well-approved ship, for determining absolute time. Professor Thomson referred to the sound and thorough mathematical theory which had been given by Mr. Archibald Smith, and the thoroughly practical manner in which he had applied it, and brought it into form for practical use, in the real circumstance of sea-going ships, by which Professor Thomson believes much has been done to give security to modern navigation. Professor Thomson referred to the case of the wreck of the Tayleur, which the late Dr. Scoresby, whose loss was so much felt by this section, had attributed to a change of the magnetism of the ship (a new iron ship), produced in consequence of being tossed about the Channel in a gale within a few hours after leaving Liverpool; and remarked that it appeared strongly to corroborate the opinion now expressed by the Astronomer Royal, that new iron ships are liable to sudden and great changes of magnetism on being knocked about in rough weather at sea.—Mr. TOWSON considered that iron ships were as safe as wooden ships, and remarked that they were insured at the same premium as class A 1 at Lloyd's, which would not be the case if they incurred more risk. He believed when the evils of the compass were got over, they would be by far the safer class of ships.

ON THE RAPIDITY OF SIGNALLING THROUGH LONG SUBMARINE TELEGRAPHS:

BEING A PAPER READ BY W. F. JENKINS, AT THE BRITISH ASSOCIATION, SECTION A., 1859.*

THIS paper detailed certain experiments undertaken at the establishment of Messrs. R. S. Newall and Co., Birkenhead, with a view to verify the theory of retardation, and to supply certain constants required. This theory has been well developed by Professor Thomson, and is confirmed by the results of these experiments, which have indeed only been rendered possible by the peculiar construction of Professor Thomson's marine galvanometer. In this instrument momentum and inertia are almost wholly avoided by the use of a needle weighing only 1½ grain, combined with a mirror reflecting a ray of light which indicates deflexions with great accuracy. By these means a gradually increasing or decreasing current is at each instant indicated at its due strength: thus, when this galvanometer is placed as the receiving instrument at the end of a long submarine cable, the movement of the spot of light, consequent on the completion of a circuit through the battery cable and earth, can be so observed as to furnish a curve representing very accurately the arrival of an electric current. Lines representing successive signals at various speeds can also be obtained, and by means of a metronome dots, dashes, successive A's, &c., can be sent with nearly perfect regularity by an ordinary Morse key, and the corresponding changes in the current at the receiving end of the cable accurately observed. The strength of the battery employed was found to have no influence on the results; curves given by batteries of different strengths could be made to coincide by simply drawing them to scales proportionate to the strengths of the two currents. It was also found that the same curve represented the gradual increase of intensity due to the arrival of a current, and the gradual decrease due to the ceasing of that current. The curves of arrival obtained for lengths of from 1,000 to more than 2,000 nauts were found to agree very closely in general appearance with those given by Professor Thomson's theory (*Proceedings of the Royal Society*, May, 1855). In the curves representing dots and dashes sent at high speeds successive dashes appear in quite a different part of the scale from that occupied by dots. It is in these cases obvious that no delicacy of relay will enable us to indicate both of these signals at a constant adjustment, nor does any increasing strength of battery help us, for though the variations of intensity are absolutely increased, the relative position of such changes to one another on the scale remain unaltered. The magnitude of the first appearance of a current at the far end of a cable may, however, be increased by the use of powerful batteries, and delicate instruments would permit the faintest appearance to be observed. By these means one isolated signal might be sent with great rapidity. Returning to the consideration of successive signals, when the speed of transmission is diminished, the oscillations of the spot increase in size, those for dots and dashes overlap one another, and would give legible Morse signals by means of a relay, the amplitudes of oscillation representing any letter or letters were found to be proportional to the amplitude representing dots. The speed of signalling possible can therefore be measured by that amplitude as soon as in one case it is determined what speed of dot signalling is compatible with the reception of all other combinations of dots, dashes, and spaces. This amplitude is modified by the nature of the receiving instrument, by the nature of the signal, by the skill of the manipulator, &c. The possible speed of signalling was found to be very nearly proportional to the squares of the lengths spoken through; thus, a speed which gave 15 dots per minute in a length of 2,191 nauts, reproduced all the effects given by a speed of 30 dots in a length of 1,500 nauts. At these speeds, with ordinary Morse signals, speaking would be barely possible. In the Red Sea, a speed of from seven to eight words per minute was obtained in a length of 750 nauts. This result agrees very closely with the deduction from the experiments at Birkenhead, and apparently shows that the influence of electro-magnetic induction, due to the disposition of the cable in coils, does not very materially retard the possible speed of signalling. The amplitudes of oscillation representing dots can be thrown into a curve which will be the same for all lengths. By this curve we can determine from one single observation, on any cable, the amplitude of oscillation due to any speed, and, consequently, the possible speed of signalling on that cable. This method, however, of determining the possible speed of signalling, presupposes that a considerable length of the cable shall have been manufactured. Mechanical senders, and attention to the proportion of the various contacts, would materially increase the speed at which signals of any kind could be transmitted. The best trained hand cannot equal the accuracy of mechanism, and the slightest irregularity causes the current to rise or fall quite beyond the limits required for

* *Athenæum.*

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WHITWORTH'S MEASURING MACHINES.

Fig. 1.

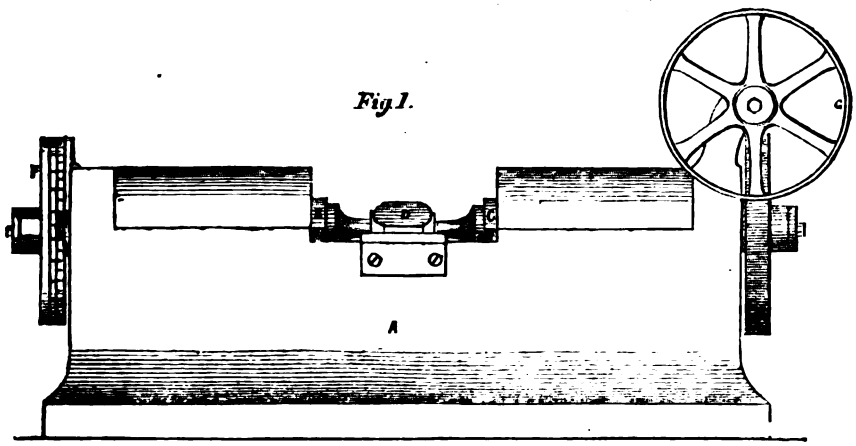


Fig. 2.

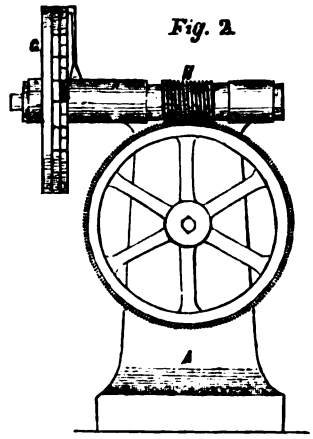


Fig. 3

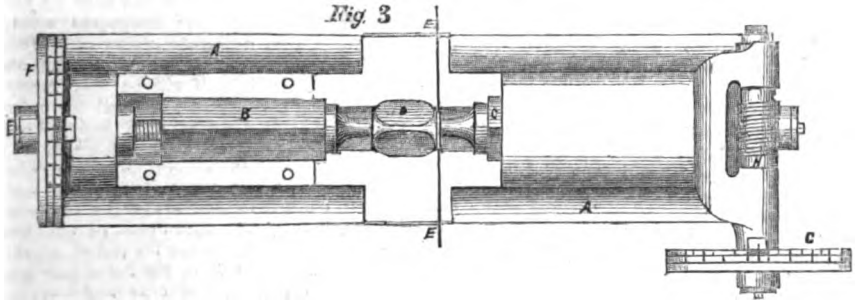
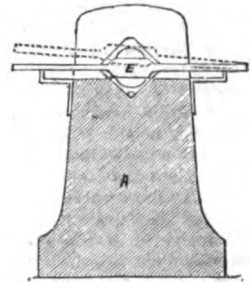


Fig. 4.



distinct signals. No important difference was observed between signals sent by alternate reverse currents and those sent by the more usual method. The amplitude of oscillation, and consequent distinctness of signalling, was quite the same in the two cases. An advantage in the first signals sent is, however, obtained by the use of Messrs. Siemens and Halshe's submarine key, by which the cable is put to earth immediately on signalling being interrupted, and the wire thus kept at a potential half-way between the potentials of the poles of two counteracting batteries employed, and the first signals become legible, which, with the ordinary key, would be employed in charging the wire. This paper was accompanied by illustrative diagrams, by means of which the results referred to were exhibited to the section.

WHITWORTH'S MEASURING MACHINES.

By Mr. JOSEPH WHITWORTH, the Inventor.*

THE principle of the machine for measuring lengths or thicknesses to the millionth of an inch is simply to compare the end measure of a bar or other piece with a corresponding standard bar of known length, and to ascertain their exact difference of length; the new piece is first made slightly too long, and then gradually brought to the exact length of the standard by successive processes of shortening and remeasurement. The principle is the same as that of measuring by ordinary callipers for end or outside measurement, only that in the latter process the accuracy of measurement is limited by the uncertainty and irregularity in the tightness of fit of the callipers upon each of the two pieces successfully gauged by them, causing a variation in the measure obtained on account of the elasticity of the instrument allowing it to yield to a variable extent with the variable pressure of contact. In my machine this pressure of contact between the measuring callipers and the ends of the piece to be gauged is exactly regulated to the same amount in every case, by causing a small parallel steel plate, called the *gravity piece*, to be held suspended between the two surfaces by this pressure of contact; the surfaces being in each case gradually brought together by a fine micrometer screw, until the fact of the gravity piece becoming suspended between them instead of falling freely marks that the exact limit has been obtained.

The machine is shown in Figs. 1 to 4, one-third full size: it consists of a rigid cast-iron bed *A*, having two heads like lathe heads, fitted with sliding square bars *B* and *C*, each advanced by a screw of 20 threads per inch; the bed has a right-angled V groove between the heads, corresponding exactly with the square sliding bars; all the surfaces are made true planes and accurately at right angles. The standard bar for measurement *D* is also square, as shown full size in Fig. 6, fitting exactly in the V groove of the bed; and the ends of all the bars are reduced to a circular plane truly at right angles to their axis. In adjusting the machine the bar *B*, shown uncovered in the plan, Fig. 3, is first advanced by means of the divided wheel *F* fixed upon its screw and having 250 divisions on its circumference, each division giving a motion of 1-5000th of an inch; and the final fine-adjustment is then given by moving the bar *C* by means of the second-motion wheel *G*, which has also 250 divisions on its circumference, but carries a tangent-screw *H* driving a wheel of 200 teeth fixed upon the screw of the bar *C*, each division of the wheel *G* consequently giving a traverse of 1-1,000,000th of an inch to the sliding bar *C*. The gravity piece *E* rests at each end upon the projecting edges of the bed, and is moved vertically by the finger between the end of the standard bar *D* and of the sliding bar C: it is lifted at one end into the position shown by the dotted lines in Fig. 4, and at first falls freely when released; the sliding bar *C* is then gradually advanced by means of its screw until the pressure of contact is sufficient to support the weight of the gravity piece, which then remains suspended between the ends of the bars when lifted, still moving freely when touched but not being able to fall by its own weight. The exact position of the wheel *G* is then noted, by observing the reading of the divisions on its circumference: the standard bar *D* is then removed, the bar *C* being drawn back by the wheel *G*. If it be required to produce a duplicate of the standard bar *D*, the proposed duplicate is put into the machine, its ends being made true planes at right angles to its axis; one end of the dupli-

Fig 5

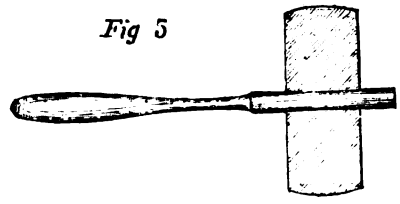


Fig. 6

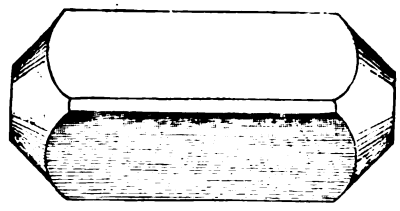


Fig. 7

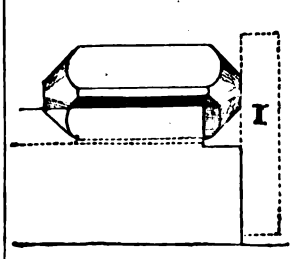
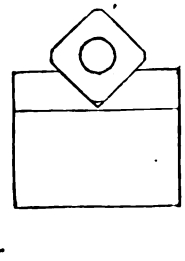


Fig 8



* From the official report of the Proceedings of the Institution of Mechanical Engineers.

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cate is placed in contact with the end of the bar *B*, which has remained unmoved since the last measurement; the gravity piece *E* is lifted by the finger and allowed to fall between the other end of the duplicate and the end of the bar *C*. The bar *C* is gradually advanced by means of the wheel *G*, until the fall of the gravity piece is just arrested; the reading of the wheel then indicates whether the proposed duplicate is of exactly the same length as the standard, and shows the difference to the millionth of an inch.

[The machine was exhibited in action by Mr. Whitworth at the close of the meeting of the Institution of Mechanical Engineers, showing that an advance of ·000001 inch (1-1,000,000th of an inch) was distinctly indicated by the gravity piece becoming suspended instead of falling; and the turning back of the divided wheel through two divisions, representing ·000002 inch, was then sufficient to cause the gravity piece to drop, and included consequently all the play in the four bearings of the two screws and two collars. Mr. Whitworth showed also that the fineness of measurement obtained by the machine was sufficient to detect the expansion in length of an inch bar caused by a momentary touch of the finger, the bar then measuring ·000001 inch longer than previously; (the expansion of iron being about 1-150,000th of its length for each degree Fahr., a rise of temperature of 1-7th of a degree expands an inch bar 1-1,000,000th of an inch). He stated that in his larger machine for measuring the standard yard, with a bar 36 inches long, the same amount of expansion was shown by the momentary contact of the finger nail. The finest measurement required the precautions of freedom from dust and moisture in the atmosphere, and from any current of air interfering with uniformity of temperature; and the machine was therefore kept in its glass case during the time of use, with an opening only sufficient for moving the micrometer wheel and lifting the gravity piece; by sufficient care in these respects the measure of a space corresponding to half a division on the wheel, or 1-2,000,000th of an inch, had been rendered distinctly perceptible. Specimens were exhibited of the decimal wire-gauges made by Mr. Peter Stubs, of Warrington, from Mr. Whitworth's standard gauges, having the new decimal Nos. on one side from No. 18 to 300, measuring ·018 to ·300 inch, and the corresponding old wire-gauge Nos. 26 to 1 on the other side. Also specimens of the Decimal Rules made by Mr. Sampson Aston, of Birmingham, from Mr. Whitworth's standard 30 inch steel bar; 20-inch flat-jointed rules corresponding to the ordinary 2 feet workmen's rules, and 30-inch folding rules (2½ feet) divided on the four sides. It was stated that the decimal wire-gauges were now regularly supplied by the maker at 7*s* 6*d*. each; and the decimal rules at 1*s*. to 3*s*. each, several hundreds of the 20-inch rules being already in use.]

In the decimal wire-gauge that I have recommended, I have simply taken the sizes of the old iron wire-gauge, using all those that were accurately represented by thousandths of an inch, and avoiding a change of the sizes now in regular use. All the change I propose is, to call these sizes by a fresh number indicating their exact value in thousandths of an inch. In order to obtain great exactness, the decimal wire-gauges are made from standard flat gauges; the two faces of the gauges are true parallel planes, and I find there is no difficulty in making these standards correct to 1-40,000th of an inch by means of the measuring machine, from the great accuracy of the sense of touch: a separate gauge is made for each notch in the wire-gauge. The standard gauges for larger dimensions are made in a cylindrical form, from ·10 inch up to 6 inches diameter; the smallest size, ·10 inch, is shown full size in Fig. 5; these are casehardened and got up very true, and last a long time, as they present a very large extent of wearing surface. I consider that for the shop the use of standard gauges is better than any measuring machine, on account of the difficulty of using a sufficiently delicate instrument in regular shop work, and the greater liability there would be to alteration in the standards both of diameter and length.

The method of working by end or contract measure is far superior to that of line measure. The latter was the plan previously used, and was adopted for determining the length of the Government standard yard measure, which was a gun-metal bar with two transverse lines upon it 36 inches apart: in order to render minute differences of dimension applicable to the eye, a microscope was fixed over each end of the bar, adjusted by a micrometer screw so as to be exactly over the two transverse lines; the two microscopes were fixed in their position by clamping screws, and the bar being replaced by a second one, the transverse lines on the latter could be compared with the original and the difference measured and registered by the micrometer screw. There was, however, no means of finally correcting the position of the line, but it had to be left when very nearly correct, and the exact amount of error whether in excess or defect then registered by means of the micrometer attached to the microscope. The effect of the microscopes in this case was simply to increase the extent of surface over which the eye traversed in measuring the distance, so as to render minute distances appreciable to the eye; but the extent to which it was found this could be carried by means of microscopes was very limited and uncertain as compared with the method of end measurement. In the measuring machine a motion of ·000001 inch (1-1,000,000th of an inch) in the screw is represented by nearly ·04 inch upon the circumference of the dividing wheel; so that the machine magnifies 40,000 times, and the eye traverses over 40,000 times the space that is being measured. No practical use can be made of microscopes in the workshop; and workmen can only set callipers to a gauge, and require standards of touch or end measure to work to. With practice, the sense of touch is able to detect extremely minute differences of length: by holding a parallel piece, such as one of the wire-gauge standard plugs, between two true-plane surfaces, and making them just touch, I can tell, though blindfold, if one of them is moved 1-50,000th of an inch nearer to the other, by the difference in the feeling of tightness between the surfaces; and with the measuring machine a motion of one-millionth of an inch is distinctly perceptible.

In reference to engines and machinery of different sizes, I do not think the advantage of exact measurement is less in practice than in the case of a great repetition of the same articles; for whether an engine is of 500 or 20-horse power, an inch and its subdivisions are the same in both, and the same degree of accuracy is required in both, since the best and most satisfactory work is that where the individual parts are accurately made independently by means of gauges, without requiring to be fitted to one another. The best makers of cotton machinery now make the spindles and other working parts by standard gauges alone, and produce the exact fit required in the parts separately, without fitting them to one another before they are finally put together; and the same plan ought, I consider, to be adopted in all engineering and machine shops, as the most economical as well as most perfect mode of executing the work.

Evidence was given by the Astronomer Royal and myself before a select committee of the House of Lords in 1855, with respect to the comparative accuracy of line and end-measure for ensuring a permanent national standard of length. I am desirous that the old standard line-measure should be replaced by an end-measure; for in line-measure the limit of accuracy that could be attained by the use of microscopes was practically only 1-10,000th of an inch. An objection then urged against the plan of end-measure was that its accuracy depended upon the ends of the bar being truly at right angles to its axis, so as to ensure the same measurement at every point of the ends; but this difficulty is completely met by the mode I have adopted for their construction, which is simply an adaptation of the principle of the true-plane that formed the basis of all accuracy in mechanical work. The bar, Fig. 6, is laid in a grooved bed consisting of two true-planes, as shown in the diagram, Figs. 7 and 8, with the ends of the bar and of the bed also true-planes, and approximately at right angles to the longitudinal axis; a trial plane is then applied to their ends, as shown by the dotted lines *I*, in Fig. 7, being slightly rubbed to mark the points of contact, and the ends are then reduced to a common true-plane by the ordinary process of scraping. The bar is then turned over, and the same process repeated, taking the correction half off the end of the bar and half off the end of the bed; and by successive repetitions of this process, with the bar resting on each of its four sides alternately, the ends of both the bar and the bed are brought to a true-plane at right angles to the axis of the bar, so that the trial plane is in contact over the entire surface of both, in whatever position the bar is placed. A second objection urged against an end-measure standard was, that it was exposed to alteration from the wear of the ends by use: but the force of this objection disappears when it is considered that duplicate copies of the original standard can be supplied in any quantity, and the original standard itself will be only rarely used for verifying the copies employed for reference. For the original standard, hard jewelled ends are proposed to be employed. I further urged upon the committee at the same time to recognise also a standard inch and foot, and to recommend Government to have standards of these lengths supplied to the manufacturing towns throughout the country. There is actually no authorised legal standard now used except for drapers' measure. A standard inch and foot of end-measure was finally recommended; but the original standard yard of line-measure was still adhered to, and authorised copies of the end-measure standards have as yet been only partially supplied. Correct standards can be truly obtained only by end-measure; and, if Government will determine to carry out the system of end-measure, I am ready to make the country a present of my two measuring machines—the inch machine, and the larger machine, which extends to 40 inches in length. As to the question of Government fixing any universal unit of measure by Act of Parliament, I think it is not at all likely, and would not be the correct course of proceeding; this should be initiated by those using the measure, and I think that if mechanical engineers and manufacturers decimalised the inch and worked to it as the unit of measure, adopting this universally for all their dimensions, they could then urge upon Government for general use that which their experience had proved to be the best.

"PHOTOGLYPHIC" ENGRAVING.

MR. FOX TALBOT'S NEW PROCESS.

A PLATE, either steel, copper, or zinc, having been well cleaned, is to be rubbed with a linen cloth dipped in a mixture of caustic soda and whiting, and afterwards rubbed dry with another clean cloth; this process should be repeated twice. Coat the plate with a solution composed of 1 part of gelatine to 30 parts of water and about 8 parts of a saturated aqueous solution of bichromate of potash. Pour the solution on the plate in the dark room as if it were collodion, drain off the superfluous liquid, and dry over a spirit lamp. The plate is then ready for exposure. Lay the object to be copied upon the plate, and expose in the copying frame in the usual way—from one to several minutes in the sunshine, and for a much longer period, if the sun is obscured; the operator must use his judgment in this matter. When the exposure has been sufficiently prolonged, the frame must be taken again into the dark room, and the plate withdrawn. On removal from the frame it will be seen that a faint image is imprinted on the plate, the light having changed the yellow colour of the gelatine to a brown wherever it has acted. Sprinkle over its sur-

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face some very finely-powdered gum copal, and distribute it evenly, care being taken to leave on the plate only a very thin layer. Lay the plate, face upwards, over the flame of a lamp, until the copal is melted: this will require a considerable heat, and its accomplishment will be easily perceived by the change of colour. When this takes place, leave the plate to cool gradually. This process may be termed laying the aquatint ground.

The etching liquid is prepared as follows:—Take hydrochloric acid and add to it as much peroxide of iron as it will dissolve by the aid of heat. When saturated, filter, and afterwards evaporate it, until, as it cools, it solidifies into a brown semi-crystalline mass. This substance is perchloride of iron. It is very greedy of moisture, and absorbs it from the atmosphere, if exposed to it.

Water dissolves a very large quantity of perchloride of iron with the evolution of heat. Saturate a small quantity of water with the perchloride, and pour it into a bottle, which lable No. 1. Fill a second bottle with a mixture of five or six parts of this saturated solution, and lable it No. 2; and a third bottle with a mixture of equal parts of this solution and water, and lable it No. 3.

When the plate is quite cool, pour on it a small quantity of solution from bottle No. 2, and spread it quickly over the plate by means of a camel-hair brush, which has been used for no other purpose. The liquid will speedily begin to act on those parts of the plate on which the light has not acted—it being unable to penetrate through those parts of the gelatinous solution upon which the light has acted. The etching proceeds with considerable rapidity, and should be suffered to continue for some minutes. If the rapidity is too great, it may be checked by adding to No. 2 solution a little of No. 1, doing this with care, as the addition of too large a quantity would render its action too sluggish, and it would require to be stimulated by some of No. 3. When the exact strength required has been thus arrived at, the operator may proceed with confidence in his manipulations. The liquid must be moved about the plate during the whole operation with a camel-hair brush; and when the etching has proceeded far enough, the liquid must be wiped off the plate with a piece of cotton wool, and a stream of cold water poured over it so as to cleanse it as rapidly as possible; then wipe the plate with a clean linen cloth. When faint portions of the picture fail to appear, Mr. Talbot dips a camel-hair pencil in No. 3 solution, and touches these parts, which cause the details to appear with great rapidity; and it is evident that, in the event of its being desirable to check the action of the liquid on any part of the plate this could be accomplished by dipping a pencil in No. 1, and applying it in a similar manner.—*Photographic News.*

THE GREAT EASTERN.

(ABRIDGED FROM THE LETTER OF THE "TIMES" SPECIAL CORRESPONDENT.)

WEYMOUTH Sept. 25.

THE repairs necessary for fitting the Great Eastern for sea are daily going forward with the utmost diligence and rapidity. Yet we should be deceiving our readers if we held out the least hope that the Great Eastern will be ready for sea on the 8th of October, or perhaps even during the month of October at all. The fittings of the ship and all matters connected with her sea-going equipment are now entirely in the hands of the Marine department of the Board of Trade. With a passenger ship of such gigantic magnitude, and which when complete will go to sea literally with a population equal to that of many towns, it has been felt that no possible precautions which the greatest experience and most jealous vigilance can suggest should be neglected. In this matter the directors and Captain Harrison are entirely agreed, and have, we believe, asked the Board of Trade to make any suggestions which they think can in any way conduce to the safety and convenience of the vessel. Several suggestions will, therefore, doubtless be offered at once, and, as a matter of course, complied with to the letter by the executive on board. Some of the most prominent of these suggested improvements are already known, one being that the coal bunkers should all be well ventilated and fitted with pipes through the centre, as is the case with line-of-battle ships, to enable the temperature of the coals to be tested and registered at certain intervals throughout the day. The Great Eastern will always carry the best Welsh coals, which, even when stowed in large quantities, have seldom if ever been known to heat. The Great Eastern, however, will carry no less than 10,000 tons, a quantity which, we need not say, has never yet been put into any vessel, and therefore it has been thought right to guard against even the possibility of accident from this source. Another matter which will probably be altered is the means of feeding the boilers with water. Until the present massive engines were constructed it has always been the rule to make them self-feeding, the auxiliaries being used merely as a stand-by in case of any of the pumps breaking down. The machinery of the Great Eastern was made entirely dependent on its feed water being supplied by the donkey engines—a rather objectionable arrangement, as in case of the donkeys getting out of order, which it has been seen they may do, the machinery must come to a standstill. Feed and bilge pumps will now most likely be fitted to both screw and paddle engines, and the donkeys retained only as a precautionary measure. Two boats, in addition to those already at the davits, will be carried by the Great Eastern when she starts for sea. Each of these, in capacity, will be almost equal to small schooners, as they are to be upwards of 50 feet long, and 13 feet wide, quite capable of taking off at least 100 persons. These with boats of the same description, which have already been made, and those now alongside, will be equal to taking off at least 1,200 crew and passengers. Among the other alterations which will soon be carried into effect is fitting a different kind of stern wheel, and also making a second tiller in the lower deck connected with, though independent of, the upper one. The passage round from the Thames showed that the heat in the stoke holes of one or two of the small auxiliary engines was too much for the firemen. Sliding iron doors will, therefore, be cut in the bulkheads, in order to give them the most complete ventilation. To the auxiliary engines for turning the screw it is intended to attach pumps for pumping water out of the ship or on deck in case of fire. There will thus be two powerful fire engines in the ship, independent of the donkey feeds or feed and bilge pumps, capable in all of throwing upwards of 20 tons of water per minute in case of accident. Another suggested alteration is the removal of the india-rubber packing between the flanges to which the cast iron mast is bolted and filling in with wedges or hornbeam. This will, of course, necessitate the slackening down of the main shrouds, a work both of time and difficulty. Upon minute examination it was found that the forward boilers had not been injured to the extent which was at first imagined, nor yet escaped entirely without damage. The copper plates of these two boilers, upon which the funnel and casing rested, are very much dinted in, and many of the iron stays in the interior are either broken or very much bent. Some of the hot-air tubes have also been damaged, but not to a serious extent. The replacing of the stays and such of the tubes as it will be necessary to remove will soon be accomplished, but the restoration of the two damaged boiler-plates must occupy time. A few days will suffice to restore the injured iron supports of the main and lower decks. Thus it is to be hoped that the substantial portions of the ship will be completely refitted in the course of a comparatively few days. But with regard to the erection and equipment of the demolished cabins on the lower deck and in the saloon it would be impossible to speculate on so speedy a completion. Even should the cabins not be touched for six months to come it will not in the least degree prevent the ship from going to sea, as there is ample berth and cabin accommodation in all the remaining saloons. It is not improbable that in a few days the Great Eastern will leave her present moorings, and go round under easy steam to Southampton Water. Nothing on this point is yet finally decided.

THE GREAT EASTERN EXPLOSION.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—At the close of your last article on "The Great Eastern Explosion" you say—"We should perhaps have satisfied some few readers better if we had said less," &c.

I have been for many years one of your "readers," and I, for one, should have been better satisfied if you had left the question of *contract* between the company and Mr. Russell to the lawyers. I think very few of your readers feel much interest on this point. There is, however, a question of great interest that has not been, I think, cleared up. You have had an opportunity of inspecting the machinery, and of obtaining such information as should enable you to throw some light upon the matter.

Water-jackets, it may be argued, are perfectly safe; and it may also be argued that a cock in the standpipe is a necessary appliance, to guard against a *certain class* of accidents; but what can be said of an arrangement whereby the cocks in the standpipe could be closed without the knowledge of the engineers in charge? If the cock was necessary, as Mr. Dixon asserts it was, it should have been entirely under the control of the engineers in charge of the boilers—they should have been made aware of its use—and gearing for working the cock should have been brought to the hand and *eye* of the man managing the feed. Under such conditions the cock might have been made a tolerably safe appliance, and in case of accident it might have been of use; but to have cocks "boxed up," so that their position even could not be easily seen, was a grand error.

The cock altogether was a simple matter of detail, and its very existence might well have escaped the notice of the man to whose genius we owe the ship; it might even have escaped the notice of the designers of the engines. A man designing a great work does not necessarily, in an engineering point of view, become responsible for minute details; but some one must have been appointed, and must have accepted the responsibility of designing the boiler fittings. This person, whoever he may be, must accept the discredit of having placed a dangerous appliance, connected with the boilers, without providing means for its being worked with safety.

It cannot reflect discredit upon Mr. Brunel, and it need not deteriorate from Mr. Russell's fame as an engineer, but it is entirely beside the question arguing in whose hands the engines were at the time of the accident; the accident was due entirely to the error of fixing a cock in the standpipe without providing the means for bringing the cock under the control of the engineers, and of their control only. Yours, &c.,

A MERTHYR MAN.

Merthyr, 26th Sept., 1859.

[We have to thank our correspondent for the above useful letter, and to say that, while we think him quite correct in arguing that the "contract" had really but very little to do with the cause of the accident, the proceedings of the company's witnesses at Weymouth made it incumbent upon us to deal with the subject as we did. Knowing what we know of the extraordinary circumstances of the case, it would be impossible for us to consider the "lawyers" capable of settling the question satisfactorily. As to the mechanical feature of the case, we quite agree with our correspondent in believing that the employment of an isolated cock in the standpipe, without any indicator for bringing it duly to the attention of the engineer in charge, has proved to be a grave and dangerous error. At the same time we are not sure that even our correspondent would have observed its

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gravity and danger so clearly as he now does had it been brought to his knowledge by a less exciting circumstance than an explosion.—EDS. *M. M.*]

THE NAVIGATION OF THE AIR.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Public attention is now being directed to this subject, and many persons are in expectation of some great step being made, so as to bring its accomplishment to a mere question of time; and, with the view of helping the subject forward, I submit the following.

I may observe that I have made flying machines of various kinds. The best were those made of paper, with light wooden stays, in the form of Archimedean screws, which were set in motion by winding-up india-rubber bands or springs. They rose in the air while the springs were unwinding.

I made other screws of thin wood, which flew by a smart twist of the fingers. I also made tinned iron screws, with strong spindles, which also rose in the air; but it was requisite to give them a great speed, which was accomplished by means of a string and handle—the operation being similar to spinning a humming-top.

The result of the several experiments convinced me that an immense velocity must be given to any wings or appliances for flying; and, to get that, it would be necessary to have great power in proportion to the weight to be sustained. This was the practical result, and the theoretical one would not be far from it. To obtain a fulcrum from a highly elastic medium it would be necessary to have a large surface acting with great velocity.

The mechanical law seems to present some difficulty, because an increase in speed must have a loss of power in proportion. Notwithstanding this, I am satisfied the thing is to be accomplished without danger, or not more danger than every one encounters on a voyage in a steam-vessel.

The plan I propose is as follows:—A balloon made in the shape of a long cylinder, with pointed ends, capable of sustaining a weight of 400 to 500 lbs.—in fact, rather a small balloon.

The propelling power—a steam rocket, or several, made of the best steel plate, capable of sustaining great steam pressure, not less than 1,000 lbs. per inch, or about 1-20th of that from fired gunpowder. The steam discharge from such a rocket would strike the air nearly with the velocity of a cannon-ball; and, by its expansion in the form of a cone, several dozens of yards of surface would be acting upon the air, which surface would increase according to the altitude obtained by the balloon on account of the diminished pressure of the air.

The fire could be made from some of the gas from the balloon or from bags of compressed gas.

To prevent accidents, several balloons might be used on the principle of several compartments in a vessel, all being enclosed in one outside covering, while the balloons themselves might be made of elastic material, so as to prevent any danger from the expansion of the gas, and, at the same time, save the gas that is now let off, and therefore lost, to avoid that danger.

When I first proposed to propel boats by steam rockets acting upon the air, instead of obtaining the fulcrum by the aid of machinery upon the denser medium of water, I was laughed at, and told they would not move. Now, it is admitted that no small steam-boats with machinery will go at half the pace with double the quantity of fuel; and it seems feasible that the same power (acting upon the air) that drives a boat through water against the wind will propel a balloon through air only.

What is wanted towards the carrying of the above plan into successful operation, is a very strong and light steam rocket or boiler; and I invite boiler makers' attention to it, as I am frequently applied to for them for propelling boats.

I have used small rockets at an estimated steam pressure of 800 lbs.

I do not propose steam-rockets as a substitute for the steam-engine where a fulcrum is to be had for its action. JAMES PARKER.

THE THEORY OF A CENTRAL FIRE.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Numerous experiments on various spots of the globe, and extending to more than 20,000 feet downwards from the level of the sea, have demonstrated that pressure and the density of substances are increasing downwards.

Experiments made on the land appear to have demonstrated that *in some shafts in certain localities* the temperature rises in proportion as we descend deeper. Now, I must confess that it requires an effort to imagine a point—the centre of the earth—where we are to suppose as existing the *maximum of density at the same time with the maximum of heat.*

I have met with various springs of the greatest variety of temperature, and have been in mines in Europe, Africa, and America; and, of the former, I found the water of the warm springs *always* strongly mineralized, carrying mostly sulphur and iron, &c. In mines I found the highest temperature invariably in those that were situated in *pyritous ground;* for example, at the mine of Tharsis, in Spain (in a deposit of pyrites) you enter, horizontally, through an adit, and traversing several galleries, soon come to a spot where the heat is as intense as in an oven, and that spot is a very few metres below the surface; a similar phenomenon is observed in many other mines.

I quite agree with the remark of your correspondent "T. L. H.," as to the advisability of being always guided by already *clearly* defined laws of nature in the investigation and search for others; the *natural* course of *our* investigation is from the *surface downwards.* If we were to take for a proved truth the hypothesis of a central fire, our investigation would always be such that every otherwise clearly definable fact would bear the misty veil of hypothesis around it.

I remain, Gentlemen,
Your most obedient servant,
Sept. 25th, 1859. G. J. G.

Our Weekly Gossip.

THOSE who have watched with care the proceedings of the various sections of the British Association at Aberdeen, will not have failed to notice the active part which Sir John Bowring has played in several of them; and certainly few men of more enlarged mind or judgment could be named among that scientific assemblage. We anticipate, moreover, that when Sir John shall have overcome the serious mental depression which must have ensued upon the domestic bereavement to which he found himself subjected on his return from China, he will devote himself with earnest purpose to the question of that great reform of our coinage—its decimalisation—which is so much needed. We have stated that the Decimal Coinage Association will meet at Bradford on the 10th proximo, and from certain observations of Sir John Bowring, at a meeting of Section H, Economic Science and Statistics, on Tuesday last, there seems little doubt that Sir John intends "breaking a lance" on that subject with Lord Overstone at that place. After a paper had been read on the decimal coinage by Colonel Shortrede, the late Governor of Hong Kong emphatically expressed himself in favour of such a system. The question had been brought up in the House of Commons by himself, and the principle had been adopted by 600,000,000 of the human race. Sir John characterised the "final report," as it was called, of the Decimal Coinage Commission—in which Lord Montague, a member of it, did not concur—as "*the most one-sided report ever presented to Parliament*, excluding all evidence in favour of the decimal system, and including all possible difficulties in the way of it;' a statement which was received with loud applause. We cannot but express satisfaction with these remarks, because they embody our own views, as expressed in former articles on the matter, and demonstrate the fact that Lord Overstone, the parent of that report, is not to have it all his own way. His lordship will find Sir John a doughty antagonist, we think.

What would the Civil Service Commissioners of to-day think of the orthography and composition of the following extract from an Act of Parliament of the reign of King James VI., passed in the year 1597, and relating to a then new coinage of copper for Scotland? "In consequence of great scarcities of small penneys; concludit and resolvit that thair sall be aine hundreth stane wecht of copper unmixt with ony other mettale wrocht and forgeit in ane miln, and be the said miln maid reddy to the prenting, efter the accustomat forme of His Majestie's Cunzie house (Mint), with pyle and cursell quhairthrow the same be not counterfute for making of the said exchange and relieff of the indigence and miserie of the puir, in penney and twa penney peeis; ilk twa penny pece weyand ane denier twelff granes; quhairof three scoir foure peeis of the saidis twa penny peeis to be in the mark wecht, with twa of the saidis twa penney pieces of remaid of wecht, alswell havie as licht on the mark wecht thairof; and sax scoir aucht peeis of the saidis penney peeis to be in the mark wecht with foure of the saidis penney peeis of remeid of wecht alswell havie as licht on the mark wecht of the samin. Haveing on the ane syde the King's face bairhedit with circumscriptioun: *Jacobus 6, D. G. Rex. Swtorum.*, and on the uther syde three theissillis distinct, with this circumscriptionn, *Appilum.* Edinburgi, and the saidis peeis to have cours amangis hienes liegis for twa penneys and ane penney pece." We commend this indeed to the attention of the C. S. C., whose duty or pleasure it is to infuscate the wits of those who appear before them for examination. The State document of 1597 would thus make an excellent exercise for would-be State servants of 1859. With respect to what is termed "remeid" in the extract above quoted, it may be stated that it refers to the latitude allowed to this day in all mints in producing coins. It is not necessary, for example, that all coins of the same denomination should be of the same weight. In copper coinage this "remeid," or remedy, is considerable even in the British Mint, where great exactitude is observed. We know, for instance, that at present a pound of copper is supposed to be converted into twenty-four pence, but from imperfect working, &c., the exact fractional weight of each individual penny is not preserved. Consequently twenty-four newly-minted pence placed in a scale might be found to weigh rather more or rather less than the 1 lb. The differences plus and minus on a large quantity would, however, fairly balance each other, and just weight would thus be given to the public in gross, if not in detail. A "remeid," or remedy, on the same principle is allowed on coinages of silver or of gold although the individual difference in regard to them is much smaller. The exact remedy allowed to the Mint coiners, or those who contract with the Mint, in the production of pence, halfpence, or farthings, is, we believe, at present 175 grains per pound avoirdupoise, the standard weight of the penny being 291·66 grains. With the new mixed metal pieces—when they come—this standard weight and remedy will have of course to be re-adjusted.

The following letter on the Admiralty Works Department comes as a supplement to that which we recently published:—"To the Editors of the MECHANICS' MAGAZINE.—Gentlemen,—Your readers need not to travel so far as Pembroke Dockyard to witness the effect of Colonel Green's mania for glass roofs, they can see quite enough of it at the dockyard here. They can see the new saw-mill, with its carpenter's shop over fitted with a glass roof to give light, and a thick canvas awning to keep it dark, the workmen preferring darkness to being baked alive. Near it is a large store for transport clothing, with a glass roof so contrived that the upper floor is like an oven when the sun shines and like a shower bath when it rains—a store, be it remembered, for dry goods. In the victualling yard may be seen a clothing store with another specimen of the fondly-cherished glass roofs. It is said that the women employed therein, during the warm weather, went in a body to the superintendent, and told him that it was impossible to work there and live, when like a kind-hearted man as he is very well known to be (it is to be hoped that he is not the only one in that establishment), he ordered canvas awnings to be fitted forthwith, such as had been previously done in the saw-mill. It is also said that the tailors have asked to be allowed the use of umbrellas during the coming winter; be that as it may, certain it is that six inches of snow is frequently found on the floor of this dry (!!!) store of a winter's morning. Query—were the officers of the yard consulted in the construction of these costly architectural blunders? It is said that the officers and Colonel Green are at this moment at loggerheads about a salt-meat store which is to be built some day or other, Colonel Green maintaining that he as a soldier must know best what is wanted, the officers, (poor simple men) having nothing to prove that they must know best beyond the mere fact of their long experience in the department, an item never attended to as worth any consideration in the all-perfect works department. But surely the Admiralty will not allow another £30,000 to be thrown away in building a

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store which the officers protest will not be suitable for the purpose required, either in the construction or the position.—A SIDELIGHT, Mechanics' Institute, Deptford, 24th Sept., 1859.

A correspondent thinks the following letter would add something interesting to our recent notice of the Indian mutiny medal. He says:—"The obverse is the same as on all the previous war medals, the beautiful portrait of Her Majesty, engraved by the late Wm. Wyon, R.A. of Her Majesty's Mint (the reverse designed and engraved by his son). Inscription, 'Victoria Regina.' On the reverse we have Britannia standing resolutely erect looking to her right, helmeted, with a shield bearing the Union crosses on her left arm, and in the hand wreaths. The right arm extended with a wreath for some, we are to suppose, approaching, and as we feel assured, worthy recipient. The figure of Britannia is gracefully characteristic, the attitude, draperies, and expression, calm, resolute, and, if requisite, prepared for renewed action; and seldom has the flowing plume of a helmet overhung a more singularly earnest, yet cheerful and beautiful countenance. By her side, in grim tranquillity, stands a splendidly powerful lion, scrutinising the whole extent of vision in all the stern reality of nature, prepared and competent to destroy whoever may dare to provoke an exertion of that tremendous power, now quiescently passive. Inscription, 'India, 1857-1858. L. C. Wyon.'—R. S."

The following letter, *in re* boat lowering, tells its own tale, and is only another instance of the good that results from an efficient means of quickly and safely lowering boats being on ship-board:—"No. 2179, Royal Mail Steam Packet Company, No. 55 Moorgate-street, London, E.C., 23rd Sept., 1859, to C. Clifford, Esq., London. Sir, in the report upon the log book of the Tasmanian screw steamer belonging to this company, it is stated that on the 31st of July last, while reefing the foretop sail in a strong gale with a heavy sea on, a man fell from the top sail yard overboard, but was picked up again in a short time by one of the cutters fitted with your lowering apparatus. The directors have much pleasure in announcing to you this gratifying result of the use of your invention. Your obedient servant, R. P. T. Reed, Secretary."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 513, 533, 534.
BOILERS AND THEIR FURNACES, &c. *None.*
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 477, 483, 493, 497, 507, 523, 529, 537.
SHIPS AND BOATS, including their fittings, 480, 502, 515, 544.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 520, 522, 531, 542.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 536.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 481, 482, 485, 486, 487, 489, 494, 495, 499, 503, 509, 510, 514, 517, 519, 525, 528, 532, 538, 545, 546, 550.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 547.
LIGHTING, HEATING, AND VENTILATING, 491, 527, 549.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 504, 516, 545.
METALS, including apparatus for their manufacture, 500, 501, 511, 526.
CHEMISTRY AND PHOTOGRAPHY, 488, 506, 518.
ELECTRICAL APPARATUS, 512
WARFARE, 535.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 478, 479, 484, 490, 492, 496, 498, 505, 506, 508, 521, 530, 539, 540, 541, 543, 551.

477. R. W. JOHNSON and W. STABLEFORD. "Improvements in axle-boxes." Dated Feb. 21, 1859.

The object here is to facilitate the application of grease, oil, &c., to the axle-boxes and journals of railway rolling stock, and to protect the lubricating material from dust. The patentees use a syphon or case inserted in the present chamber. On the back part of the axle-box they use a cover or shield with a lubricator, and support the same in position by spiral, bow, or other springs connected to the axle-box. Or they use a double self-adjusting slide with lubricator supported in position from a staple or slide, or from the bottom part of the axle-box, and worked by a lever or levers or with racks and wheels; springs may be used with these slides if necessary. *Patent completed.*

478. J. SCHLOSS. "An improvement in locks or clasps for porte-monnaies, pocket-books, bags, and other like purposes." (A communication.) Dated Feb. 21, 1859.

This relates to a previous patent dated Jan. 18th, 1856, and consists in constructing the bolt which retains the hasp in the lock in the form of a lever having for its fulcrum a pin in the lock plate; one end of the lever secures the hasp while the opposite end is made to terminate outside of and below the case of the lock; a spring inside the case presses the lever into the position to secure the hasp. When the resistance of the spring is overcome by pressing the protruding end of the lever, the hasp is raised out of the lock case either by a spring or by the finger. *Patent completed.*

479. T. SMITH. "Floating wheels for driving machinery." Dated Feb. 22, 1859.

Here the toothed or other wheel is fixed on or to a hollow cylinder which is closed at the bottom, and the driving shaft passes through the nave of the wheel and the bottom of the cylinder. This cylinder is floated in water contained in a reservoir, and motive power applied to such floating cylinder, wheel, and shaft, by gearing or bands for driving the machinery. *Patent abandoned.*

480. W. SOELMAN. "Improvements in the construction of propellers." Dated Feb. 22, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

481. J. GRIMOND. "Improvements in the treatment and preparation of jute and other fibrous materials, and in machinery or apparatus employed therein." Dated Feb. 22, 1859.

The patentee softens the jute and other fibrous materials by a heating process. The machinery consists of a heavy block of wood or metal, over which are placed a number of lifting beaters, which are raised by wipers and allowed to fall by their own weight on the jute, &c., as it passes over the block. There are suitable arrangements of bands and rollers for feeding the material to the block to be beaten, and for conveying it from the block after the beating operation. *Patent completed.*

482. J. CURTIS. "The manufacture of military sash net, and machinery to be employed therein." Dated Feb. 22, 1859.

This consists in causing the threads of silk bullion or otherwise to be arranged longitudinally side by side to the required width for forming the sash, and separately attached through the intervention of beadles and looped harness to a vertical standard frame, a shifting bar and tappet action being employed for giving an alternating movement to the threads or warp during the elevation and depression of the beadles, and consequent opening of the shed, by which arrangement a continuous overlapping of the threads or warp is obtained, and the net or fabric produced, the texture thereof being formed and regulated by the introduction of a wire of the requisite thickness between each shed, and the striking up of the work effected in like manner by hand laths or beaters. *Patent abandoned.*

483. W. S. CLARK. "Improvements in the formation of cast-iron rails for city railways, and also in the method of uniting the ends of two adjacent rails for railway use." (A communication.) Dated Feb. 22, 1859.

This invention cannot be described without reference to the drawings. The applicant claims the construction of an upright self-sustaining rail of cast-iron with car and carriage track combined, and secured and united at the joints by an upright iron splice wedge, and also the application of the splice wedge to any kind of rail, by the addition of cleets and grooves, either in parallel lines to receive and hold the compound wedge, or by conveying lines of cleets at and adjoining the ends of the rail to receive and hold the single wedge. *Patent abandoned.*

484. J. HINE. "An improved book slide." Dated Feb. 22, 1859.

This consists in adding to expansible spring book slides a rack and catch by which the slide when drawn out is retained until released by pressure of the finger on the end of a rod in connection with the catch. *Patent abandoned.*

485 E. LUND. "Certain improvements in the manufacture of fabrics or textures to be used in the construction of umbrellas and parasols." Dated Feb. 22, 1859.

This consists in so weaving the fabric or texture to be used in covering the frames of umbrellas and parasols that it shall be thicker or more substantial at those parts which by repeated folding are most likely to become worn. *Patent completed.*

486. R. A. BROOMAN. "A method of fixing tannin upon textile fibres, and the employment thereof in dyeing black and dark colours." (A communication.) Dated Feb. 22, 1859.

The patentee claims the method of fixing tanning upon textile fibres by means of chlorides or other salts of tin, or by means of any other equivalent substance, that is, any other substance which will act as a reducing agent and form with the tannin a composition insoluble in water, as described. He also claims the employment of this method of fixing tannin in dyeing black and dark colours. *Patent completed.*

487. T. R. HARDING. "Improvements in the manufacture of card surfaces to be used in preparing fibrous materials." Dated Feb. 22, 1859.

Here the inventor covers the card cylinders with segment cards, the backs or stocks of which are made either of wood or composition and fitted with steel pins; and to ensure the pins being firmly held in the stock he covers the outer face of the segment with sheet metal, which will serve to support the pins; and further to prevent the wood from splitting he covers it with strong canvas. These segments of cards he secures to the cylinder by screws. There are other features included. *Patent abandoned.*

488. W. GOSSAGE. "Improvements in the utilization of alkali-waste." Dated Feb. 22, 1859.

This invention relates to a former one patented, dated Feb. 21, 1857, and comprises the application for the extraction of sulphur from alkali-waste, of carbonic acid gas which is produced during the manufacture of alkali, when sulphate of soda or sulphate of potash is decomposed by means of carbon at a red heat. *Patent completed.*

489. A. W. SMETHURST. "Improvements in machinery for driving looms for weaving." Dated Feb. 23, 1859.

This consists in fixing the driving pulley to a supplementary shaft, to which is fixed a cone; a similar cone is also fixed to the crank shaft, and a strap passes around the cones, thereby communicating motion to the supplementary shaft. The cones are placed in contrary directions. *Patent completed.*

490. S. RIDGE. "Improvements in coupling or making the joints of pipes and other articles." Dated Feb. 23, 1859.

This consists in certain modes of making joints to be placed between the flanges of pipes, &c., requiring to be coupled or jointed together. *Patent completed.*

491. W. ASHTON. "Improvements in gas regulators." Dated Feb. 23, 1859.

This consists, 1, in means of establishing a state of equilibrium in the regulating valve, so that the control of the movements of that valve by the pressure of the gas in the branch may not be interfered with by the irregular pressure of the gas in the street main. 2. In the use of india-rubber in forming the joint or packing by which the back of the regulating valve is insulated. 3. In a like use of india-rubber in making the joint or packing of the hood, disc, or moveable diaphragm of the receiver. *Patent completed.*

492. G. DAVIES. "Improved apparatus applicable to the evaporation of saccharine liquids, and for the concentration of heat for other purposes." (A communication.) Dated Feb. 23, 1859.

This apparatus is applicable principally to the ordinary pans used for boiling sugar, and consists in the application of a floating cover thereto of a peculiar novel construction. *Patent abandoned.*

493. U. SCOTT. "Improvements in carriages, and various parts of the same, which parts may be applied to vehicles of any description." Dated Feb. 23, 1859.

This consists in the application of felt, gutta-percha, india-rubber, &c., in combination with metal in making various parts of carriages. *Patent completed.*

494. W. SHARP. "Certain improvements in machinery for spinning and twisting worsted, cotton, silk, and other fibrous materials." Dated Feb. 23, 1859.

The inventor proposes to prevent the occurrence of "snarls" by the action of pressure upon the threads, which upon some yarns may be continuous, whilst upon others it may be so applied that when the machine is at rest the pressure shall be such that it will gently hold the thread, or operate as a slight drag upon it, thereby preventing it from curling. *Patent abandoned.*

495. S. R. SAMUELS. "Improvements in twist lace machines." Dated Feb. 23, 1859.

Here twist lace machines are constructed so that a larger number of warp bars can be arranged between the ends of the bolts or combs. *Patent completed.*

496. S. RUSSELL. "An improvement in the manufacture of handles for tea and coffee pots, jugs, kettles

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knives, daggers, and forks, or any other description of article to which handles are applied." Dated Feb. 23, 1859.

This consists in forming handles of various descriptions of pieces of ivory, cane, bone, horn, or fancy woods, glass, porcelain, or papier mâché, which would otherwise be comparatively useless. *Patent completed.*

497. G. TURNBULL. "Improvements in the permanent way of railways." Dated Feb. 23, 1859.

Here longitudinal sleepers or bearers of iron are used, and the rails are fixed thereto by screw bolts and nuts. The sleepers are formed with a longitudinal groove in them for preventing any lateral movement of the rails. There are other features included. *Patent completed.*

498. H. B. BARLOW. "Improvements in apparatus for condensing steam." (A communication.) Dated Feb. 24, 1859.

This consists in obtaining the requisite vacuum or partial vacuum in the condenser without the aid of a pump, the steam being brought into contact with cold water which is not under atmospheric pressure. *Patent completed.*

499. J. ROBINSON. "Improvements in machinery and apparatus applicable to machines for spinning and doubling." Dated Feb. 24, 1859.

This consists in the application to mules of a vessel containing any lubricating material, and furnished with brushes for cleaning and for distributing the lubricating material. *Patent abandoned.*

500. R. MUSHET. "A new metallic compound or alloy." Dated Feb. 24, 1859.

This consists of a metallic compound or alloy of the metals tungsten, iron, and manganese. *Patent completed.*

501. R. MUSHET. "An improvement in the manufacture of cast steel." Dated Feb. 24, 1859.

This consists in adding to cast steel and combining therewith metallic compound of tungsten, iron, and manganese. *Patent completed.*

502. J. HOLMS. "Improvements in machinery or apparatus for propelling vessels, ships, and boats." Dated Feb. 24, 1859.

Under one modification of the details of this invention a pair of parallel horizontal steam cylinders are fitted up in the stern of the vessel beneath the level of the water-line, one on each side of, and parallel with, the keel. Each piston rod is connected with a horizontally propelling rod, the axes of the two rods being in one and the same line. The vessel receives a powerful propelling motion ahead by the simple reciprocating action of the pair of steam pistons, as when open the floats expose their full propelling surface to the water, and thus secure the necessary resistance for causing the vessel to move. *Patent abandoned.*

503. J. CROSLAND. "Improvements in looms for weaving textile fabrics." Dated Feb. 24, 1859.

This relates to the production of fancy goods, and consists in working two or more shuttle boxes, and regulating the picking motion by the same jacquard machine which forms the shed in the warp. *Patent completed.*

504. A. LANÇON, jun. "A new system of watches." Dated Feb. 24, 1859.

This consists principally in a new escapement, which is by simple or dead beat, and its use permits the suppression of the fourth catching—that is to say, one of the four which generally form the movement of a watch. *Patent completed.*

505. J. H. G. D. WAGNER. "Apparatus for cleaning water, and removing all matters in suspension and dissolution contained in it, water intended to feed generators of all sorts (applicable also to other purposes), which besides previous to its getting into the generators is heated to the highest degree without almost any expense." Dated Feb. 24, 1859.

This comprises, 1, the subdivision of the water to be purified into thin continuous sheets or films of indefinite length to be heated in this extended state. 2, The double traverse of the liquid film or sheet over the two surfaces of partitions, upon which are deposited and kept adherent all the incrustations. 3. The heating of the liquid fluid or sheet by the direct contact of steam, and on surfaces directly heated by steam. 4. The condensation of the escaping or waste steam during its continuous flow being increased by means of partition work in the interior of the apparatus, which flow is always inversely to that of the water current, or of any other liquid to be heated. *Patent completed.*

506. J. DALE. "Improvements in concentrating caustic alkalies, and in applying a product therefrom to the purpose of obtaining motive power, and to other purposes." Dated Feb. 24, 1859.

This consists in a method of economizing the evaporation of solutions of caustic alkalies. This is accomplished by placing the fluid in a close vessel, to which heat is applied by any ordinary means, and the steam arising therefrom is applied as a heating medium for evaporating another quantity of solution, to effect which the said steam may be caused to pass into a coil of piping, into a false bottom, or other ordinary evaporating apparatus. *Patent completed.*

507. E. PRICE and E. HAWKINS. "Improvements in the mode of forming fish plates, and in the method of fixing or attaching them to the joints of rails on railways." Dated Feb. 24, 1859.

This invention is not described apart from the drawings. *Patent completed.*

508. A. C. KEILY. "Improvements in apparatus for drawing-off fluids." Dated Feb. 24, 1859.

This invention consists in connecting a vent-hole with a tap by an elastic tube, so shat when the tap is turned the vent is opened, and *vice versâ*. *Patent abandoned.*

509. A. REID and R. TONGE. "Certain improvements in weaving, and in the machinery employed therein." Dated Feb. 25, 1859.

This invention is not described apart from the drawings. *Patent completed.*

510. A. REID and R. TONGE. "Certain improvements in, or applicable to, looms for weaving." Dated Feb. 25, 1859.

This applies to the reed, or that part of the loom by which the weft is struck into the cloth, and it consists in placing the dents or wires of the reed on curved or diagonal lines instead of in a straight line as heretofore. The object is to produce fabrics in which patterns are woven by striking the weft into the cloth in irregular lines. *Patent abandoned.*

511. T. C. HINDE and G. J. HINDE. "Improvements in coating iron with copper, or alloys of copper." Dated Feb. 25, 1859.

In carrying out this invention the iron is first coated with tin, zinc, or lead, or any compound of these metals. It is afterwards plunged into molten copper, or alloys of copper, and subsequently placed in an annealing pan together with fine charcoal dust, or iron filings, or iron borings made by preference from cast iron, and the annealing pan and its contents are then placed in an annealing oven or muffle and subjected to the required amount of heat. *Patent completed.*

512. C. W. SIEMENS. "Improvements in electric telegraphs and apparatus, and in supports for electric telegraphic line wires." (Partly a communication.) Dated Feb. 25, 1859.

The release and stoppage of the clockwork of various descriptions of electric telegraphic apparatus is sometimes effected by the hand of the attendant, and sometimes by contrivances operating by electricity. The patentee here constructs an improved electrical apparatus for this purpose. The invention, which likewise embraces various other apparatuses and numerous details, is not described apart from the drawings. *Patent completed.*

513. W. MCNAUGHT. "Certain improvements in steam engines, particularly applicable to compound steam engines." Dated Feb. 25, 1859.

This consists in applying to the present form of engine, known as "McNaught's double cylinder engine," a cylinder or cylinders, connected either to the crank-shaft of the engine, or to the engine, through the medium of gearing, the steam being supplied to this cylinder or cylinders in the usual way, and thence passed to the condenser or condensers of the engine or engines. It also comprises other features in connection with the cylinders and condensers of steam engines. *Patent completed.*

514. R. FIELDEN, jun., and T. FIELDEN. "An improvement or improvements in the manufacture of pickers to be used in looms for weaving, and also in the machinery or apparatus to be employed in the manufacture of the same." Dated Feb. 25, 1859.

This invention is not described apart from the drawings. *Patent completed.*

515. J. REDDIE. "An improved mode of propelling and steering vessels." Dated Feb. 25, 1859.

Here the inventor constructs a flexible paddle or rudder of steel plates, or steel, or whalebone, or other elastic ribs covered with gutta percha, &c., so that it may possess the yielding property of a fish's tail. *Patent abandoned.*

516. G. PROVER. "An improved optical instrument, being an improvement upon the kaleidoscope." Dated Feb. 25, 1859.

Here the pieces composing the object are arranged around a rotating shaft mounted horizontally in a box on which the tube of the instrument is secured. In this box is an opening to admit light. *Patent abandoned.*

517. W. CLARK. "Improved apparatus for spinning, twisting, doubling, and drawing fibrous materials. (A communication.) Dated Feb. 25, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

518. F. WEEKES. "The treatment of certain alcoholic products." Dated Feb. 26, 1859.

This consists in adding to the alcoholic products obtained from beet root, mangold wurtzel, &c., essence of cogniac, or other flavouring matters, in order to impart to such products the taste and character of brandy, whiskey, hollands, or gin. *Patent completed.*

519. G. EARNSHAW. "The treatment of woollen and other rags and waste of fibrous substances, so as to obtain useful products therefrom." Dated Feb. 26, 1859.

This relates to reducing such substances to a powder or dust, which dust may be used in various manufactures, and consists in subjecting rags to the action of a grindstone or other rough surface in motion. *Patent abandoned.*

520. J. LEE. "Certain improvements in ploughs." Dated Feb. 26, 1859.

The patentee mounts too wheels (the furrow wheel and land wheel) on different axles. The axles are suspended each from an axle or suspension rod. The bottom end of this axle rod is slotted out, and the axle can be set at any part in this slot. The upper ends of these rods have strong spiral springs round them, and pass into, and are suspended from, a frame which is firmly fixed to the beam of the plough. Upon pressure being applied to the wheel, it, along with its axle and axle rod, will move freely in a vertical plane, without acting on the beam of the plough, and on the pressure being removed the springs will force them back to their normal position. By this action, and the slot at the bottom of the suspended rod, the plough will always cut to a uniform depth, and will require scarcely any guiding save to direct the horses. *Patent completed.*

521. J. HINE. "An improved joint for cabinet making, carpentry, and other constructive purposes." Dated Feb. 26, 1859.

This consists in arrangement of grooves or tongues formed upon the edges of the several articles to be jointed together, so as to obtain a more permanent fixed or sliding joint than hitherto, the said joint being employed in lieu of tenons and mortices. The invention is not described in detail apart from the drawings. *Patent completed.*

522. W. BURGESS. "An improvement in reaping and mowing machines." Dated Feb. 26, 1859.

This consists in constructing reaping and mowing machines so as to facilitate their ready turning while in motion; and is particularly applicable to those machines where the inner bearing wheel is in a line behind that of the main wheel. This end is attained by forming a hinge joint behind the finger beam in the side frame to which the small or inner bearing wheel is connected. In consequence of this arrangement an additional side frame is provided to which the upper part of the back framing of the machine is connected. *Patent completed.*

523. E. GATWOOD. "Improvements in buffing, traction, and bearing springs, applicable to railway carriages and locomotive engines." Dated Feb. 28, 1859.

This consists in making spiral or conical shaped steel springs with ribands of steel rolled with one edge thicker than the other, so that the coil may wedge and fold, one layer within the other, and indeed greater resistance by friction. But to increase the resistance of the springs the patentee applies steel rings or hoops, the ends being open so that the expansion of the spiral spring will be elastically resisted to increase the power. *Patent completed.*

524. F. BRIGNOTES. "The disinfection and rectification of alcohol by the separation of the essential and other oils from the alcohol." (A communication.) Dated Feb. 28, 1859.

This consists in condensing the alcoholic vapour at different degrees of temperature and in separate worms, surrounded by water in worm tubs, the temperature of each being marked by degrees. The invention is not described apart from the drawings. *Patent completed.*

525. A. MARTIN and A. CRICHTON. "Improvements in weaving and woven goods." Dated Feb. 28, 1859.

This consists in the substitution of shedding apparatus in the power loom so constructed as to weave either plain or tweeled cloth, or plain cloth into which is introduced tweeled stripping. The invention is not described in detail without reference to the drawings. *Patent completed.*

526. J. HOWDEN. "Improvements in machinery or apparatus for cutting, shaping, punching, and compressing metals." Dated Feb. 28, 1859.

In a modification of this machinery suitable for making bolts, rivets, &c., the dies are carried by two

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circular tables turning about vertical spindles, and upon circular stools or beds. These die tables are placed at each end of the machine, and there is situated between a T shaped lever fast on a shaft turning in bearings formed in the tops by projecting portions of two side frame pieces, constituting the main parts of the framing, and between which the die table stools are bolted. The T lever is made to vibrate by means of a crank shaft working within the lower forked end of the middle or vertical leg of the lever, this crank shaft receiving motion from the driving shaft. The horizontal arms of the T lever are each connected to a vertical heading ram working in a guide carried by a transverse frame piece, also serving to bend the frame together, and the two cams are actuated alternately, the respective die tables being turned between each stroke of each ram to bring a fresh blank round to be shaped. The tables are turned by ratchet movements actuated each from the vertical leg of the T lever by a lever and links, and the T lever is also made to actuate bell crank levers, which at the proper periods push out the bolts or rivets by vertical spindles passing through the bottoms of the dies. A couple of pairs of cutters are arranged at the side of the machine to cut the wood for forming the bolts or rivets into proper lengths, these cutters being actuated by an eccentric on the driving shaft, and being arranged to drop the blanks into a receptacle from which they are taken and placed in the dies. *Patent completed.*

527. J. LEIGH. "Improvements in the purification of coal-gas." Dated Feb. 28, 1859.

This consists in the constant and extensive use of gas-water, in the purification of coal or cammel gas, the object being the removal of various salts of ammonia from the gas. *Patent completed.*

528. G. HORNER. "Improvements in hackling flax and other fibrous materials, and in machinery for the same." Dated Feb. 28, 1859.

This relates, 1, to a mode of mounting hackles or hackle bars on the belts, straps, sheets, or chains of sheet hackling machines, so that the hackle points will enter the pendant strick or stricks of fibrous material at right angles to a vertical line, or nearly so. 2. To a mode of arranging stripper cocks or slot plates of hackling machines at the bottom sheet, pulleys or shafts being detached from the sheets, and making, when at work, one continuous circular or excentric movement round the bottom sheet pulleys or shafts to which they are attached. 3. To a certain mode of stripping the tow from the hackles of an extreme fineness. 4. To those machines where two are combined in one, and consists in arranging the troughs so that one is going up while the other is coming down, thereby dispensing with balance weights or springs. 5. It consists in applying a second slide or catch bar for taking out a strick holder from any gradation of hackles, so that the stricks of fibrous material will not get any more hackled than is sufficient for them. *Patent completed.*

529. J. H. JOHNSON. "Improvements in apparatus for stopping horses." (A communication.) Dated Feb. 28, 1859.

This consists of two pressing pads, which are attached to a blade spring secured to the front of the nose-band, and which are caused to approach each other and pinch the nose of the animal at a particular point a little above his nostrils, on tension being applied to a suitable curb rein, which passes through each end of the spring, and through a spring behind the animal's jaws. *Patent completed.*

530. J. H. JOHNSON. "Improvements in apparatus for taking soundings, applicable also to the throwing of life-lines. (A communication.) Dated Feb. 28, 1859.

This consists of a metal tube or casing for containing a requisite number of balls of line placed one above the other, and having the outside end of the line of one ball connected to the inside end of the line of the next ball, so as to connect the whole of the balls. One end of the line is secured to the starting point, and the other attached to the plummet or projectile, the line being discharged as the plummet or projectile descends or advances. *Patent completed.*

531. C. HALL and C. HALL, jun. "Improvements in steam agricultural machinery." Dated Feb. 28, 1859.

This consists, 1, in the use of a single winding drum with a continuous spiral on its periphery, on which the rope for drawing the implement is wound. 2. In the use of an anchor having two circular inclined grooves fitted on the spindle on which the wheel or pulley round which the traction rope passes is keyed. Into these grooves studs or pins on the ends of two levers enter, the inclined grooves being so formed that upon the rotation of the spindle the levers are caused to move up and down. From the levers depend other vertical levers carrying spring pauls or ratchets which drive ratchet wheels keyed upon a shaft on which a screw is fixed. This screw on being moved enters the soil and drags the anchor after it. 3. In means of taking up the slack ropes in implements used in steam agriculture by the use of two drums loose on the axe of each implement. *Patent completed.*

532. A. TURNER. "Improvements in the manufacture of elastic fabrics." Dated Feb. 28, 1859.

This consists in producing a woollen surface on elastic fabrics by twisting together a fine yarn of cotton, silk, flax, worsted, and fine wool. *Patent abandoned.*

533. A. V. NEWTON. "Improvements in constructing and working condensing engines." (A communication.) Dated Feb. 28, 1859.

This chiefly consists in combining the air-pump and cylinder of a condensing engine, and so applying the cold water injection that condensation is effected in the air-pump, and the use of a separate vessel as a condenser dispensed with. *Patent abandoned.*

534. W. HODSON. "Improvements in rotatory engines." Dated Feb. 28, 1859.

This consists in fitting cylinders with screw-like or other inclined vanes, so that steam entering at one end of a cylinder and passing off at the other, will cause the cylinder to rotate with, or on, its axis, as may be arranged. *Patent abandoned.*

535. R. BROWN and W. MILNE. "Improvements in fire-arms." Dated Feb. 28, 1859.

This consists in applying a bolt or stop so as to prevent the hammer striking the cap or priming and thereby exploding it, until such bolt or stop is withdrawn by the combined acts of pressing the butt of the fire-arm against the shoulder, and of passing the hand on a moveable piece in the stock. *Patent abandoned.*

536. E. J. HUGHES. "Improvements in preserving animal food, poultry, game, fish, fruit, and other similar substances." (A communication.) Dated March. 1, 1859.

This consists in submitting the above substances to the action of a bath of tartaric acid, and in neutralising the taste of the acid by a bath of bi-carbonate of sodium. The substances are then put into vessels containing boiled water and salt, and the vessels are then hermetically sealed. *Patent completed.*

537. T. CLOAKE. "Stopping of the bodies and wheels of railway and other carriages." Dated March 1, 1859.

This consists of an apparatus whereby the breaksman, at the same time that he applies the breaks of the van, also applies them to the wheels of the other carriages of the train, the break surface of each carriage being so connected by levers that the motion and force applied becomes a thrust between one wheel and the other, so that the force applied to one wheel is the support or abutment of the pressure applied to the other. The power is applied by an upright screw and hand wheel, the screw nut of which rises or falls on such screw, and so actuates the horizontal arm of the lever, by which the power is increased and transmitted to the connecting links and levers of the break surfaces. On one of the levers a pin is mounted which takes the slot of an arm projecting from a horizontal rod carried throughout the length of the carriage, and supported in bearings in which it slides lengthways, the rod of one carriage being connected by a link piece to the rod of the next carriage. The invention also relates to a coupling for connecting railway carriages to each other, which allows a certain amount of play between the carriages, at the same time checking for the most part the violent action and re-action of the buffers when any slight collision occurs. *Patent completed.*

538. J. HOLROYD. "An improvement in finishing woollen cloths, and cloths made from a combination of wool and other materials." Dated March 1, 1859.

This consists in so finishing woollen cloths that an ornamental design is produced upon a plain surface of the cloths. This is effected by cutting the nap shorter in certain parts than in other parts, the whole of the nap after the production of the design thereon being laid in the same direction as heretofore. *Patent abandoned.*

539. Rev. H. MOULE. "Improvements in apparatus applicable to the evaporation of sewage or other waters, and for affording heat for other uses." Dated March 1, 1859.

This consists of a cistern fitted with a suitable arrangement of pipes, and heated by a fire underneath it, by means of which the process of evaporation is effected. *Patent completed.*

540. J. WETHERILT. "Certain improvements in locks." Dated March 1, 1859.

This relates to the "alphabet" or "combination" lock, and consists in so arranging the mechanism thereof as to adapt the same for cash-books, portfolios, trunks, &c. *Patent abandoned.*

541. J. EDWARDS. "Improvements in stacking or holding biscuit, earthen, china, and glossed ware for firing." Dated March 1, 1859.

This consists in the employment for each separate article of a ring frame or holder with a flange projecting inwardly so as to occupy the whole or part of the centre of the ring. *Patent completed.*

542. G. P. RIVERS, BARON RIVERS. "An improved implement for breaking up and preparing land." Dated March, 1, 1859.

This consists of a rotary cultivator composed of a drum or cylinder, or of a skeleton drum armed with tines fixed at intervals across the length and around the circumference of the drum. *Patent abandoned.*

543. J. TEMPLEMAN. "Improvements in the manufacture or production of artificial fuel." Dated March 1, 1859.

This relates to a previous patent of the patentee, and consists in the combination with artificial resinous fuel of dried wood, &c. *Patent completed.*

544. J. PILE. "Improvements in the construction of floating docks." Dated March 1, 1859.

This consists in the use of two sets of pontoons, the one set being kept constantly floated, and the other set being alternately submerged and floated for sinking beneath the bottom of the ship, and of then rising and lifting the ship up with it, the water being pumped out of the submerged pontoon by rotatory pumps or otherwise. *Patent completed.*

545. D. LICHTENSTADT. "Converting certain vegetable substances into fibrous materials for the manufacture of paper, textile and other fabrics." Dated March 1, 1859.

This consists in a process for converting the plant or plants of the genus Bambusa, and Bambusa arundinacea, into fibrous material for the purposes specified in the title of the invention. The details are voluminous. *Patent completed.*

546. J. T. CARTER. "Improvements in machinery for crushing, bruising, and preparing flax, hemp, and other fibrous materials requiring such treatment." Dated March 2, 1859.

This relates to a previous patent of the patentee dated Feb. 1, 1847, and consists in the substitution of the force of buffer or other springs in lieu of the force of gravity of the upper roller. *Patent completed.*

547. P. CURRIE. "Certain improvements in spindles for locks, latches, and other door-fastenings." Dated March 2, 1859.

The patentee claims a method of combining or connecting knobs to locks and latches, so that a perfect contact shall be made and maintained between the base of the neck of the knob, as may be required, and the follow of the lock, or latch, to which the knob or knobs are connected, by which means a positive and agreeable action is imparted to the handle when in use." *Patent completed.*

548. J. VALDA. "Improvements in studs and other like fastenings for dresses, belts, or other purposes." Dated March 2, 1859.

This consists in making the stud in two distinct parts, the face and back of the stud being secured together by spring catches or otherwise. *Patent abandoned.*

549. J. M. ADAMS, D. LAW, and J. INGLIS. "Improvements in fire places, grates, ranges, and stoves." Dated March 2, 1859.

This relates to fire places, grates, ranges and stoves, and has for its object the more effectual carrying out of the system according to which the coal is burned from above downwards, together with convenience of arrangement, and other advantages. *Patent abandoned.*

550. R. H. COLLYER. "A process of preparing materials for the manufacture of paper, and a machine employed therein, which machine is applicable for crushing, grinding, bruising, and reducing various substances." Dated March 2, 1859.

This consists in a method of treating straw, flax, &c., for the manufacture of paper. The straw, &c., is first boiled in water, and then subjected to the action of certain machinery (which we cannot describe for want of space) which opens and breaks it, and prepares it for the subsequent action of caustic alkali; it is then freed from the alkali by washing, and next bleached by steeping it in a solution of chloride of lime. It is finally treated with sulphuric acid and carbonate of lime. *Patent completed.*

551. W. F. DEARLOVE. "An improved chopping machine." Dated March 2, 1859.

This consists of a cylindrical box, the bottom thereof forming the chopping board, the same being made with a flat or curved surface. The top of this

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box is susceptible of having a rotary motion imparted to it without detaching it from the box. The knives are arranged so as to cross each other, or are placed at suitable distances parallel to each other. In the interior of the drum is placed a frame provided with teeth or scrapers which free the knives from any substances adhering to them. The chopping is performed by lifting the knives up and down by the handle, the position thereof being from time to time changed by causing the cover of the box to revolve, and thus carrying with it the knives together with the frame before mentioned. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Aug. 6, 1859.

1814. C. C. R. Goudenove and A. Feret. An improvement in gas burners. (Partly a communication.)

Dated Aug. 16, 1859.

1886. W. Leatham. An improved double acting superlative screw throttle valve.

Dated Aug. 22, 1859.

1910. J. Gregory. Improvements in locomotive and other steam-engines.

Dated Aug. 30, 1859.

1970. J. H. Johnson. Improvements in the construction of steam generators, applicable also to the construction of condensers, the heating of water generally, and to the warming of buildings. (A communication.)

1972. G. Collier. Improvements in chairs and couches.

1974. J. Field. Improvements in apparatus for superheating steam.

1976. H. Hutton. An improved lubricator.

Dated Aug. 31, 1859.

1978. J. Cowgill and J. Stocks. Improvements in "caps" for spinning fibrous substances, and in the means or method of manufacturing the same.

1980. W. A. Von Kanig. Improvements in the manufacture of starch and compounds of starch, and in extracting gum dextrine and grape sugar therefrom.

1984. J. Mackenzie and S. T. Wentworth. Improvements in breech-loading fire-arms.

1986. J. Samuel. Improvements in railway-sleepers.

1987. H. Higgin. Improvements in machinery for cutting and preparing match splints.

1988. L. Berge. An improved method of fastening or securing portemonnaies, bags, and other like articles with frames.

1990. E. Ellis. Improvements in finishing silk fabrics made on bobbin net, and warp frames.

Dated Sept. 1, 1859.

1992. J. Brine. Improvements in the mode of preparing, arranging, and combining, the leaves of books to be used for producing simultaneously one or more fac-simile copies of letters, accounts, or other such similar documents or writings.

1996. J. Borrington. Improvements in pumps.

Dated Sept. 2, 1859.

1998. P. Wright. An improvement or improvements in the manufacture of anvils.

2002. J. K. Watson. Improvements in gas meters and exhausters, washers, and purifiers.

2004. W. Clough. Certain improvements in machinery or apparatus for propelling vessels on water.

2006. W. A. Turner and H. L. Lilley. Improvements in the manufacture of starch.

2008. J. F. F. Leroux. A new or improved apparatus to be employed for taking money on the counters.

2009. T. Hedgcock. An improvement in quadrants.

2010. J. Spurgin. Improvements in ordnance and projectiles.

Dated Sept. 3, 1859.

2018. G. Parsons. Improvements in wheels.

2020. H. Swan. Improvements in stereoscopes and stereoscopic pictures.

Dated Sept. 5, 1859.

2022. F. C. Bakewell. Improvements in the manufacture of caustic alkalies. (A communication.)

2026. W. L. Earle. Improvements in apparatus for promoting the combustion of smoke and gases arising from fuel.

2028. A. V. Newton. Improvements in sewing machines. (A communication.)

Dated Sept. 6, 1859.

2030. G. Lowry. Improvements in machinery for heckling flax and other fibrous materials.

2034. A. V. Newton. An improved fabric, applicable to the manufacture of hose or flexible pipes. (A communication.)

2036. E. Blake. Improvements in apparatus for and in treating china grass rhea, fibre mudar, and other similar vegetable fibres.

Dated Sept. 8, 1859.

2049. T. Hooman. An improved stock, cravat, or neck muffler, or wrapper.

2051. J. Nicholson. Improvements in horse rakes.

2053. J. Thorley. An improved preparation of food for cattle and horses.

2055. T. W. Allsop. Improvements in portable gas apparatus.

Dated Sept. 9, 1859.

2057. W. Roscoe. An improved agricultural implement or machine for distributing guano and other manures upon land.

2059. J. G. N. Alleyne. Improvements in the manufacture of wrought iron beams.

2061. F. Carpenter. An improved apparatus for cutting tobacco.

2063. S. Cornely. An improvement in the permanent way of railways. (A communication.)

Dated Sept. 10, 1859.

2065. H. O. Robinson. Improvements in machinery or apparatus for the manufacture of sugar.

2067. J. Pollock. Improvements in the manufacture of beds, couches, and invalid or other carriages.

Dated Sept. 12, 1859.

2071. T. G. Gutch. The improvement of copying books, for order books, and letter books, and so forth, as the improvement can be applied.

2075. F. Heindryckx. Improvements applicable to railways or tramways.

2077. F. Versmann and A. Oppenheim. Improvements in the treatment of various substances, so as to render the same noninflammable.

2079. F. N. Gisborne and L. S. Magnus. Improvements in telegraph cables.

2081. H. G. Collins. Improvements in producing printing surfaces on stone, metal, and other materials capable of being employed in printing, in the manner of lithographic stones; also in the production of printing plates and surface printing blocks, and in transfer inks.

Dated Sept. 13, 1859.

2085. G. M. Levi. Improvements in washing and separating ores and substances of different specific gravities, and in apparatus for that purpose.

2087. J. Grainger. Improvements in breech-loading fire-arms, and in moulds for making projectiles.

2089. W. E. Newton. Improved apparatus for drying paper and other fabrics. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(From the London Gazette, Sept. 27, 1859.)

1207. J. M. Munro. Chain harrows.

1224. A. R. Landre, P. Gras, and A. L. A. Boucherie. Distilling.

1231. E. Charlesworth. Fire-arms.

1238. R. A. Brooman. Heating. (A communication.)

1241. G. Walker. Looking glasses.

1247. J. H. Johnson. Calcining ores. (A communication.)

1264. G. Burnell. Medicine for curing ague.

1269. R. A. Brooman. Axles. (A communication.)

1277. G. Davies. Submarine transport. (A communication.)

1276. G. D. Jones. Mills.

1284. A. J. Sax. Wind musical instruments.

1294. J. Mallett. Regulator for time pieces.

1296. J. Howard. Horse-rake.

1300. H. W. Patrick. Substitute for ivory.

1324. M. Davis. Wheels, axles, and boxes.

1341. S. Carr and G. Butterworth. Felted cloth.

1356. S. Bury. Textile fabrics.

1357. S. Bury. Textile fabrics.

1358. W. H. Parkes and W. Bagnall. Hats.

1360. J. B. Pascal. Hot air engines.

1361. J. Wilson. Carbonate of soda.

1390. R. Barclay. Paper.

1406. T. Greenshields. Purifying gas.

1442. J. Luis. Syphon meter. (A communication.)

1449. T. E. Tallent. Leather.

1461. D. Deas. Reaping machines.

1467. J. Luis. Windmill. (A communication.)

1511. E. T. Hughes. Artificial stone. (A communication.)

1519. W. Clark. Sewing machines. (A communication.)

1519. W. J. T. Williamson. Gas burners.

1594. W. Knapton and A. Aitchison. Gas.

1602. J. Luis. Wheel tyres. (A communication.)

1669. J. Bailey. Stretching fabrics.

1748. A. Sidebottom. Separating animal fibre from mixed fabrics.

1807. N. Berry. Knitted fabrics. (A communication.)

1870. W. Green and W. and F. B. Fawcett. Rugs.

1958. E. Rettig. Anchors. (A communication.)

1972. G. Collier. Chairs and couches.

1974. J. Field. Superheating steam.

1987. H. Higgin. Match splints.

1990. E. Ellis. Silk fabrics.

2065. H. O. Robinson. Sugar.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

LIST OF SEALED PATENTS.

Sealed Sept. 22, 1859.

719. J. Davis.
724. J. T. Pitman.
725. E. Maynard.
726. S. Newington.
728. W. P. Wilkins.
731. R. A. Brooman.
732. J. Tyssen.
733. C. A. Watkins.
735. S. Oram.
738. W. Middleship.
740. B. Browne.
742. G. Neal.
746. F. Tillett.
747. W. & J. Garforth.
749. W. E. Wiley.
750. F. E. Sharp.
752. C. Sanderson.
756. R. Baker.
762. W. Redgrave.
763. E. Steane.
765. M. Firth.
766. G. Naylor.
767. J. C. Evans and P. Soames.
771. J. Buckley, O. Greenhalgh, and R. Hutchinson.
773. C. F. Vasserot.
774. J. Buckingham.
779. C. L. Roberts.
781. J. W. Kelly.
785. R. Searle.
786. I. Spight.
787. T. Taylor.
788. H. P. Burt.
789. H. Moss and T. West.
889. J. H. Young.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2235. J. Cottrill.
2239. W. Beatson.
2251. J. J. Russell and J. B. Howell.
2265. D. Law and J. Inglis.
2315. P. A. de Fontaine-Moreau.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

11. T. W. Gray.
12. T. W. Gray.
70. R. Lakin and W. H. Rhodes.
264. A. V. Newton.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Sept. 23, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
422	1 0	447	0 4	466	0 3	473	0 3	486	0 3	500	0 4
432	0 6	448	3 6	461	0 8	474	0 6	487	0 3	501	0 4
434	0 10	449	0 6	462	0 11	475	0 6	488	0 4	502	0 3
435	1 4	450	0 3	463	0 10	476	0 3	489	0 9	504	0 7
436	0 3	451	0 3	464	0 3	477	3 1	490	0 9	506	0 3
437	0 11	452	0 3	465	0 3	478	0 6	491	0 7	511	0 4
438	0 3	453	0 3	466	0 3	479	0 3	492	0 3	516	0 3
439	2 5	454	0 3	467	0 10	480	0 5	493	0 10	517	0 5
440	0 7	455	0 3	468	0 6	481	1 2	494	0 3	518	0 3
441	0 8	456	0 7	469	0 9	482	0 3	495	0 3	522	0 5
442	0 3	457	0 3	470	0 3	483	0 5	496	0 3	526	0 11
443	0 8	458	0 9	471	0 7	484	0 3	497	1 4	745	0 9
444	0 3	459	0 7	472	0 3	485	0 3	498	0 5	910	0 6
445	0 5										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
Aug. 23,	4196	W. Keates, Cheadle ...	Last stand.
,, 24,	4197	T. De La Rue and Co., Bunhill-row	Fastening.
,, 27,	4198	H. Elliot, Birmingham	Cartride case drawer.
,, 30,	4199	Fenwick Brothers, Gravesend	Trowsers.
Sept. 26,	4200	C. Wall, Birmingham..	Keg or cask.
,, 27,	4201	Armstrong and Hogg, Edinburgh	Gas burner.
PROVISIONAL REGISTRATIONS.			
Aug. 24,	1098	M. Boyle, Queen-sq. ...	Trunk.
,, 26,	1099	Nicholls and Chatwin, Birmingham	Gas burner.
,, 26,	1100	T. E. Whiting, Goswell-road.....	Pencil.
,, 29,	1101	W. Lee, Islington	Chess & draught board.
,, 30,	1102	G. Tillett, Islington ...	Nut for bedsteads
Sept. 7,	1103	T. E. Ladd, Lambeth...	Watch protector.
,, 13,	1104	A. Granger, High Holborn	Envelope.
,, 14,	1105	S. R. English, Birmingham	Letter-copying apparatus.
,, 17,	1106	G. R. Spurr, Tottenham-court-road	Syringe ring.
,, 26,	1107	T. Long, Notting-hill...	Trap.
,, 26,	1108	P. Warren, Staffordshire	Signal.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 7, 1859.

THE BRITISH ASSOCIATION FOR ADVERTISING INVENTIONS.

It is all very well, perhaps, to dignify humble things with high-sounding titles, but it is nevertheless desirable that their true nature should be known. There may be nothing very baneful in designating a motley group of men "The British Association for the Advancement "of Science," or in enticing the second personage in the realm to pronounce an elaborate eulogy upon it; but at the same time it seems only proper to make known the kind of purposes which the Association seems really intended for. We have no desire to meddle with what does not much concern us, and therefore we say nothing of the Geological, or the Zoological, or the Physiological, or the Ethnological, or any other Section of the British Association which is foreign to our calling; but with the "Mechanical" section we think we have something to do, and therefore venture to make a remark or two upon it.

Now, from an article which we publish on another page, it appears that at the late meeting of the Association at Aberdeen, some four-and-thirty papers (neglecting two Reports of Committees) are said to have been read in this section. About nine of these seem really not to have been papers at all, in the ordinary sense of that term, but were either mere verbal addresses which are not likely to obtain any permanent record, or else remarks written so imperfectly that probably no more will be heard of them. This leaves, then, about five-and-twenty as the total number of the papers communicated to Section G. Of these, six related exclusively to steam navigation, and, although none of the six was calculated, perhaps, to do much of itself in the way of advancing science, it may be hoped that from all of them together —being the productions of Admiral Paris, Admiral Moorsom, Mr. Oldham, Mr. Atherton, Mr. Henderson, and Mr. Elder—some good may result. But if we omit these six papers (all on one subject), we reduce the total number to nineteen; and of these nineteen—and this is the fact to which we wish to draw especial attention—upwards of one-half are very little more than mere advertisements of new inventions—many of them patented, some of them worthless. They comprise descriptions of Mr. Artoun's patent safety cage for miners, Mr. Robertson's patent chain-propeller, Mr. Clifford's patent boat-lowering apparatus, Mr. Wood's patent apparatus for that purpose, Mr. Clark's patent steam jet for locomotive furnaces, Mr. Allan's gas meters, Mr. Robb's reciprocating propellers, Mr. Rettie's lamp, Mr. Hart's railway gas apparatus, Captain Addison's coal-pit balloons, Mr. Johnson's pressure gauge, some one's patent evaporating pan, and so forth.

Now, we are not about to find fault with the Association for encouraging inventors to do a little business in a respectable way; by no means. We may, perhaps, think it a little strange to find ourselves invited to go all the way to Aberdeen in order to hear a dozen gentlemen read descriptions of inventions which were published months ago, in the form of patent-specifications, and articles in scientific journals. And we may also, perhaps, think it still more strange that we should be invited to go there to hear nonsensical schemes propounded with a total disregard of everything like scientific reasoning. But these things may be inseparable from the advertising trade.

What we *are* about to do is to see that, since this so-called Association for the Advancement of Science is in reality (in so far as the mechanical science section is concerned) mainly an Association for the advertisement of inventions, the fact shall be properly made known. And with this view we call the attention of our business readers to the fact. There are about 3,000 inventions patented in this country every year, and as many more, we doubt not, conceived by persons who do not care to patent them. We honestly believe that on the average these inventions are equal in merit to those lately brought to the notice of the British Association. Here, then, is a field for Section G! No less than six thousand papers may be read to its scientific (!) members at the next year's Oxford meeting, and a like supply be repeated for their "advancement" annually! As the section has this year afforded unmistakeable signs of barrenness, we doubt not they will pass a vote of thanks to us next year for the suggestion.

But it is not so much in the interest of the Association as in that of inventors and men of business generally that we pen these remarks. We turn to you, ye tradesmen and manufacturers, on whose eyes the "main chance" is supposed to be ever gleaming, and we ask you why are you so blind to this "splendid opportunity?" Why pay us for allowing you to praise your goods on our covers, and yet omit to speak of their merits to the Prince Consort at Aberdeen? Be not so dull next year. Go ye, then, to Oxford, classic Oxford, with your able, imposing papers, and under the plea of the advancement of science practice the science of advancement. Pray feel no delicacy in the matter. You have as good a right to be heard there next year as some whom we have mentioned had to be heard in Aberdeen this year. And we doubt not you will be made welcome. Only avoid being too simple and candid. Remember it is in the name of "Science" that you speak, and therefore omit not to speak largely. Be sure and begin with a grave preliminary dissertation of some kind You will not find it difficult to do this. The principle of association of ideas will help you. There are plenty of great things in the world to tack little things on to.

Nor should it be forgotten that Section G of the British Association is a very aristocratical body: that is to say, there are many aristocrats who find it amusing to go to its meetings, and sit on its committees, and therefore do so. Only think, for example, of a deputation like that on steam ship performance which this section sent a few months since to the First Lord of the Admiralty, and which consisted of Messrs. M'Connell and Scott Russell, and of the Marquis of Stafford, the Earl of Caithness, M.P., Lord John Hay, Lord Clarence Paget, M.P., the Hon. A. Ellis, M.P., the Hon. Captain Egerton, R.N., and Mr. Smith! Such a group going into Whitehall to represent the science of naval architecture must, of course, have been a capital practical joke to those noble lords and honourable gentlemen who took part in the proceeding; and as lords and gentlemen must have their laugh out of something or somebody it is pleasant to see them adopting so very innocent a mode of getting it. But it is to the fact of such persons being present at the Association's meetings that we wish to direct the attention of our business friends. It is not every day that a manufacturer or a tradesman can manage to get a score or two of noblemen and a hundred or two of gentlemen to listen to him while he expatiates upon the merit of his last new article—his "latest novelty." But he could have done it this year at Aberdeen; he may do it next at Oxford; and he may repeat the process year by year, until the gentlemen of Section G begin to see some glimmering of what science is, and what its advancement means.

A NAVAL LESSON BY A FRENCH ADMIRAL.

Admiral Paris, C.B., of the Imperial French Navy, Major-General Maritime of the Port of Brest, in an address on the manœuvring of screw ships delivered at the late Aberdeen meeting of the British Association, has given our naval officers a lesson which they will do well to study. The work on "Naval Warfare with Steam" which Sir Howard Douglas recently published is most usefully supplemented by this speech, in which Admiral Paris has embodied many valuable facts which could only have been acquired by a naval officer in active service. The high standing of Admiral Paris as a scientific officer in his own country, will enable English officers to listen with satisfaction to his observations, while the knowledge that such men as he hold high rank in the French Navy should stimulate them to the most ardent study of every new phase and ramification of their profession. Such men as Admiral Paris will play a most important part in future naval wars, and it is to be hoped they will not be without many rivals in our own service. Those observations of his to which we are about to refer, although necessarily somewhat technical, are of a most interesting kind, and will doubtless help to awaken many an officer to a better sense of the value of screw ships of war than he has hitherto possessed.

The gallant officer commenced his observations by pointing out the fact that the propelling properties of the paddle and the screw are very different according to the form, mode of acting, and especially the position of the propellers in the ship. A few words will show these differences, and will enable us to deduce the special qualities of each propeller, and thence the method of making a good use of them for the various purposes of navigation. In what follows we shall endeavour to adhere as closely as possible to the translation of the Admiral's speech with which we have been furnished. The paddle acts, as is well known, at or near the surface of the water, and forces it in the direction of the keel when working either ahead or astern. The current produced by the resistance of the water is useless to the rudder, because it acts only on the upper part, where the rudder presents no flat surface. Moreover, the action of the paddles will not affect the ship's course, unless one is immersed more deeply than the other, thus meeting more resistance, or, as is provided for in the case of some tugs, when one acts in one direction and the other in the reverse, thus causing the ship to turn. The screw, on the other hand, acts on the water by a twisted surface, which, instead of pushing back the water in the direction of the keel, gives it a whirling motion, and projects it abaft in the shape of a cone. The screw produces a current in the same way that the paddle-wheels do, but being much below the surface of the water, and just ahead of the rudder, the latter receives the impulse of this artificial current, which acts before the vessel has moved, her inertia causing her for a few minutes to resist the impulse of the propeller. Hence, a principle is deducible, viz., that a paddle-wheel vessel cannot steer without moving, and that on the other hand a screw vessel will steer *before* moving, and that even long

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after the propeller is at work if any obstacle resists its translating action.

Another difference arises from the action of the screw, because its blades are oblique to the length of the ship, and they are pushing the stern not only ahead or astern, but also sideways, so that if the water were equally resistant close to the surface and below it, the equilibrium of both vertical blades would make the screw act equally throughout its path. But this is not the case, and the water being more resistant as the depth increases, the lower blade moves with more difficulty than the upper one, and the stern is acted upon sideways in proportion to this difference in the resistances, so that the ship will not move directly forward, but, if the rudder does not balance this effect, will deviate always to the same side. This effect will naturally be more or less energetic according to the immersion of the screw and the length of pitch; for if the screw-shaft were at the level of the sea and the pitch infinite, that is, if the blade were in the plane of the axis, the stern would only be forced round, and the vessel not propelled. Consequently, in the actual state of things, the action of the screw on the stern is compounded of the propelling and of the lateral effect. This cannot be avoided, and can only be lessened by an increase of immersion, or by a reduction of the pitch. A right-handed thread deviates the ship to larboard when going ahead and to starboard when going astern: it is the reverse for a left-handed screw.

From these considerations, says Admiral Paris, "it would appear at first sight that the "paddle acts much better in making a ship "steer well than the screw, and that the dis-"turbances caused by the screw on the ship's "way presents obstacles to the management of "the ship; but it is not so, and these proper-"ties of the screw may be used in such a way "as to manœuvre in various ways impossible "with paddles." If, for instance, it is desired to turn a vessel short round at the moment before raising anchor, a paddle-vessel will want ropes, or at least sails if the wind permits, and her propeller will be used only to resist the wind, or to act in the direction of the keel. The screw, however, enables her to turn round on the same place even in a calm, for if she moves gently ahead with the anchor still holding on, the screw, by thrashing on the rudder, makes it steer the ship as though she were under way. This is well known, many vessels adopting this plan in order to acquire the right direction without moving ahead, and the moment that this is attained weighing anchor and going ahead. If she is not at anchor, a screw-vessel may be made to turn on herself, by the help of her own inertia. Thus, let the screw work back and the ship will begin to turn her head to starboard, and when she has gone half her length reverse the engine at an increased speed with the helm aport. The ship will then move ahead, still turning to the same side; and by repeating the same operation several times the turn of the whole horizon will be made in a much shorter time than would at first be supposed, and the space required to turn in will be dependent on the duration of each operation. If there is any wind the sails may be used to accelerate the evolution, either by their oblique action on the ship by the aid of the jib or mizen sail, or by increasing the speed of the screw and backing the sails. These manœuvres of screw-ships, which are manifestly of the highest importance—especially for war ships, which may require to change position in action—have often been performed, says Admiral Paris, and have enabled such ships to thread their way amongst crowded shipping in a space which would have been far too confined for a paddle or sailing ship acting without the help of hawsers.

Again, ships are often required to remain in one position without casting anchor; now, with sails, as with paddles, there is always leeway, and the ship cannot stand on unless with a beam wind. There is also a difficulty in taking another ship in tow, and as large ships require much time in sending their tow-ropes on board, they are generally obliged to drop anchor and then weigh again when the second is in tow. This is a very long operation, and can easily be avoided by making use of the before-mentioned properties of the screw when the wind is either ahead or astern. "Let us suppose, firstly," says the Admiral, "that a vessel is intending to take "in tow another lying at anchor. She will "sheet and hoist her mizen topsail and top-gallant "sail according to the wind, place herself at a "short distance ahead of the other, and work her "engine slowly. Thus, the backing force of the "mizen sails would be compensated by the head-"ing one of the propeller, and the ship acted up-"on by these two equal and opposite forces will "remain motionless; but she will steer as well "as if making way by means of the artificial "current before spoken of, and she will change "her position or remain exactly motionless, and "without any deviation of her head, as long as "may be required. I have done this several "times when ordered to take ships in tow, and "remained once more than twenty minutes with "scarcely any change of position or direction." This combination of the propelling powers of both sails and the screw may also be employed in maintaining the ships with an oblique direction of the wind, two or three points, for example, by bracing properly the mizen topsail; but then there is a slight leeway, and if the wind blows in the direction of the beam it is the usual condition of sailing or paddle-vessels standing on.

Further, it is very often useful to be able to back a vessel in any direction, and when he can do this a captain will dare to go anywhere. With a paddle-vessel this is possible for short distances, combined with the help of some sails; but with the screw alone it is impossible, owing to the side action above named: so in a calm a screw-ship cannot follow by her stern the same way she made by her head; she must have room enough to turn on herself. Again, suppose a vessel is required to remain in the same place, with the wind astern. She hoists her fore-topsails, and works her screw back; these two forces can be balanced by the throttle valve, and their propelling action brought into equilibrium. But the screw deviates the vessel to starboard, and this can be avoided by hauling on the larboard braces of the fore-topsail, so that not only the pushing actions but also the deviating ones are entirely balanced. "I have "remained at rest by these means several "times," says Admiral Paris, "and once for an "experiment for half an hour; it was on board "a frigate, 76 metres, or 226 feet long; she "changed her direction only one point and a "half of the compass, and varied in her position "only the distance between two ports; with "more attention she would have been exactly "motionless." If it is wished to make stern way, it is very easy to work the ship to accomplish this, by ordering the screw to work quicker, at the same time bracing the fore-topsail somewhat more; thus the latter will not push too much ahead, and will balance better the deviating action of the screw. "By this "method," he says, "on board the same frigate "I went astern at a speed of three knots, and "with a deviation of one point in half an hour. "The ship was steered as exactly by her fore-"topsail properly braced as by her rudder when "going ahead, the only attention required being "to proportionate the work of the screw to the "action of the fore-topsail, and to back slower "when the wind is light."

From these remarks it will be concluded that the screw ship is more handy than the paddle, not only because she steers better, but also because the deviating properties of the propeller are variably and usefully employed. This leads the gallant Admiral very naturally to anticipate that the Great Eastern will be the most handy vessel afloat, if the properties of the two propellers are usefully employed. In reality she has in her paddle engines the equivalent of a good and constant head wind, which can be used with an admirable exactness; so that if she is required to turn round on herself, let the paddle turn astern and the screw ahead; the equilibrium of these two forces will be soon obtained by giving a quicker or slower motion to either of the propellers. The artificial current against the surface of the rudder will be thus obtained without any motion of the ship, and she will turn herself very easily. The motion will be accelerated at pleasure by working the propellers with more or less energy, but always equally, which is easily obtained by looking at some point on shore, or the water alongside, and adjusting the throttle valves properly. But that is not all; she will steer even when making way astern, which would be impossible in any other vessel, unless with a good breeze acting on the topsail; for, suppose the power of the screw to be overcome by that of the paddles, the ship will go astern, but still preserve the artificial current necessary to steer, and it will be a matter for experiment to find out the proportion of the maximum of back speed at which the ship will steer, that is to say, the minimum of screw power to be employed in proportion to the paddle. This being known by experiment, the Great Eastern could go up the Thames to her moorings stern first, and steering as steadily as if she were head first; should the latter be preferred, the properties of the united propellers will still be useful; thus, if it is wished to keep her steering short without making much way, the paddles should be backed sufficiently to balance the screw, and keep the ship at two or three knots, or less, if wanted, whilst the screw is turning so as to give a speed of ten or twelve knots, and so that the helm will have an energy unknown on board any other ship, and will not be subject to the influence of tides or currents. The Great Eastern would therefore go to her moorings either head first or stern first with greater facility and security than many ships of common dimensions but moved by a single propeller.

"Being a seaman, my thoughts were naturally directed," said Admiral Paris in conclusion, "to the method of making good use of the "means put into the hands of a captain by the "skill of the engineers who invented and made "the various engines. So, from one trial to "another, and reflecting on the principle of the "action of the screw, I arrived at a new theory "on the manœuvres of these kinds of ships; and "to illustrate the difference of their manage-"ment from that of paddle vessels, I have ar-"ranged in two columns in my catechism for "seamen and steam engineers the answers to "questions on this subject, which greatly facili-"tates the comparison; the left column for "paddles and the right for the screw. A chap-"ter of 100 octavo pages has been devoted to "the elaborating the details of these practical "means of managing screw ships as easily as a "horse, and to expose in a clear manner the "variety of methods employed with each pro-

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"peller to make any manœuvre requisite in "intricate navigation, and especially on leaving "or entering crowded harbours. I should have "been glad to see these methods experimented "on, or have used them myself if permitted, on "board the Great Eastern, as this ship is the "most interesting problem of modern naviga- "tion, and one which involves not only the "speed, distance, and economy of transport, "but also the means of manœuvring with faci- "lity and security this tremendous body, the "largest ever created by man to be moved on "the seas."

HEARDER'S SUBMARINE TELEGRAPH CABLE.

This novel and interesting application of scientific research to the removal of a difficulty that threatened to circumscribe the limits of success in submarine telegraph cables, and which has excited of late considerable interest in the minds of telegraph engineers, was last week submitted by the inventor for the approval of the judges of the Royal Cornwall Polytechnic Institution, at their annual exhibition held at Falmouth. Their entire satisfaction with the efficacy of the plan, and their perfect concurrence in the soundness of Mr. Hearder's scientific reasonings, were manifested by the unanimous award of the Society's first class silver medal. Of the many modifications of which Mr. Hearder's plan for obviating the effects of induction is susceptible, he appears to have selected the following:—The wire strand, which is five or six times as large as that of the Atlantic cable, is first coated with a number of strands of a very superior flax twine, incorporated with an adhesive insulating medium, which binds them firmly together. They are laid on in a very long spiral direction, the reverse of the twist of the wire; this is secondly coated with a layer of gutta-percha, and, thirdly, with another layer of twine laid on in the same manner, but in a direction opposite to that of the first. The whole is subsequently covered with two layers of gutta-percha. In other samples the first layer of twine next the wire is omitted, and one or two layers of twine and adhesive composition are laid on after the first coating of gutta-percha, and are subsequently covered with two thicknesses of gutta-percha.

Mr. Hearder's patent mainly consists in the employment of fibrous materials between the wire and the insulating medium itself. The advantages of it are stated by Mr. Hearder to be—1st. The reduction of the disturbing influences of inductive action to a minimum upon well-recognised electrical principles, which have been submitted to the test of experiment. 2nd. Improved insulation: the heavy hydraulic pressure to which the submerged cable would be subject, not only prevents the possibility of fissures occurring in the adhesive insulating composition, but any fissures in the gutta-percha itself would be effectually filled or closed over by this composition, thereby rendering the chance of leakage from damage, resulting from rough usage to the cable, infinitely less than with gutta-percha alone. 3rd. Increased strength: every strand of twine possesses a breaking strain of about 40 lbs., consequently, as the samples contain from 25 to 50 of these strands it is evident a breaking strain of from 1,000 to 2,000 lbs. is added to that already possessed by the cable itself without the twine. 4th. Extreme lightness: the specific gravity is from 1·3 to 1·4, varying with the size of the conducting wire. 5th. Perfect facility of recovery after submersion: as the cable will support a weight five times greater than that of any portion of its length which can be submerged in depths available for telegraphic purposes, its recovery after submergence is certain and easy. With such advantages as these, it may fairly be asked, what possible objection there can be to its immediate general adoption by telegraph companies and engineers?

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

At the annual meeting of the British Association for the Advancement of Science, lately held at Aberdeen, the following papers were received in the Mechanical Science Section (Section G.), of which the Rev. Professor Willis, F.R.S., was the President.

Thursday, *Sept.* 15.

1. Report of the Committee on Steam Ship Performance. [We have been favoured with a copy of this report, and if we can extract anything useful from it for our readers, will not fail to do so.]

2. Admiral Moorsom.—On the Performance of Steam Vessels. [A copy of this paper has not yet reached us; we may state, however, that it consisted mainly of statistics.]

3. J. Oldham, C.E.—Report of the Progress of Steam Navigation at Hull. [This paper is published in our present number.]

4. Charles Atherton, communicated by H. Wright. — On Mercantile Steam Transport Economy, as affected by the Consumption of Fuel. [We have been favoured with a copy of this paper, and shall either publish or notice it in an early number.]

5. J. Macquorne Rankine, LL.D.—A Condensed Abstract of Experiments, by Messrs. R. Napier and Sons, on the Strength of Wrought Iron and Steel. [This paper will be published in an early number.]

6. Donald Bain, communicated by H. Wright.—On Harbours of Refuge. [This seems to have been a speech rather than a paper; at any rate we can at present get no report of it.]

Friday, *Sept.* 16.

1. P. Le Neve Foster.—Report of the Patent Committee. [Published in the Mechanics' Magazine for last week (Sept. 30.)]

2. William Fairbairn, F.R.S.—On Experiments to determine the Efficiency of Continuous and Self-acting Breaks for Railway Trains. [This paper is published in our present number.]

3. J. F. Bateman, C.E., F.R.G.S.—Description of Glasgow Water Works. [This was a verbal description of drawings, of which no report has reached us.]

4. R. Aytoun.—On a Safety Cage for Miners. [This was, we believe, a description of an invention recently patented by the author, the specification of which has been published in due course by the Commissioners of Patents.]

Saturday, *Sept.* 17.

1. J. F. Bateman.—On the Result of Boring for Water in the New Red Sandstone near Shiffnall, in the County of Salop. [This is published in our present number.]

2. W. Robertson, communicated by Peter Spence.—On a Patent Chain Propeller. [We have a copy of this, and will publish it if we find it of sufficient interest.]

3. Admiral Paris, C.B.—On the Manœuvring of Screw Vessels. [This is abstracted in a leading article of our present number.]

4. Arthur Taylor, communicated by H. Wright.—On the True Action of what are called Heat Diffusers. [This will be published in an early number.]

5. A. Batten.—On a Boat Lowering Apparatus. [This was a paper on Mr. Clifford's apparatus; we hope to find space for it hereafter.]

6. E. A. Wood.—On a Mode of Suspending, Disconnecting, and Hoisting Boats attached to Sailing Ships and Steamers at Sea. [This paper was not, we believe, read. We may state, however, that it consisted mainly of a description of the apparatus described and illustrated at page 105 of the Mechanics' Magazine for the 12th of August last.]

7. D K. Clark, C.E., communicated by H. Wright.—On Smokeless Coal-burning Locomotive Engines. [This is published in our present number.]

Monday, *Sept.* 19.

1. Abbé Moigno.—On a New Gas-burner.

2. Abbé Moigno.—On an Automatic Injection for Feeding Boilers, by Mr. Giffard.

3. Abbé Moigno.—On a Heliço-meter, an Instrument for Measuring the Thrust of the Screw Propeller.

4. Abbé Moigno.—On an Application of the Moving Power arising from Tides to Manufacturing, Agricultural, and other Purposes; and especially obviate the Thames nuisance.

[The above four papers were written in too imperfect English to find a place in our pgaes.]

5. Alexander Gibb.—Description of the Granite Quarries of Kincardineshire. [We have a copy of the paper, which we may perhaps publish in an early number.]

6. { Alexander Allan.—On Gas Meters.
   { Alexander Allan.—Description of an Improved Method of Obtaining a True Liquid Level. [We have a copy of this paper, but not (at present) of the drawings which illustrated it.]

7. John Robb.—On the Comparative Value of Propellers. [This paper, however fit for the British Association it may have been, has no sort of claim to be published in our columns. The invention advocated in it is a very old one, and the views of the author are not such as to help it at all.]

8. Alexander Gerard.—An Experimental Illustration of the Gyroscope. [This does not admit of publication.]

Tuesday, *Sept.* 20.

1. William Fairbairn. — Experimental Researches to Determine the Density of Steam at Various Temperatures. [An abstract of this paper will be published in an early number.]

2. J. Elder.—On the Steam Machinery of the Callao, Bogota, and Lima. [We have a copy of this, which we may publish in an early number.]

3. J. P. Joule, LL.D., F.R.S.—On Surface Condensation. [This was little more than a memorandum; no copy of it has yet reached us.]

4. Mr. Rettie.—On a Submarine Lamp. [An abstract of this will be published in an early number.]

5. G. Johnstone Stoney.—On the advantages of the 40-inch Metre as a Measure of Length. [This is published in our present number.]

6. Andrew Henderson. — On India River Steamers and Tow-boats—giving an account of their improved construction for light draft, capability for cargo, and fittings, conducive to manageability in shallow rapid rivers, &c., and of the practical value of the Dynamometer in showing the resistance of vessels in tow, at different speeds and loads, with the result of test-trials made in England. [We have not yet received a report of this paper, but have been informed that it is in the main a résumé of what Mr. Henderson has before read and published on the same subject.]

7. G. Hart.—On Gas Carriages for Lighting Railway Carriages with Coal instead of Oil. [This paper describes a method by which coal-gas *may be* applied to railway carriages. The author does not seem to be aware of what has been before proposed and done in this respect. We will, however, publish it if we find it will be of any value to our readers.]

8. Captain J. Addison.—On Coal-pit Accidents. [This paper recommends the carrying out of an idea which occurred to the gallant author on seeing a man vending children's balloons in the Rue de Rivoli, Paris, viz., that of employing similar balloons to test the atmosphere of mines, the presence of carburetted hydrogen being detected by the balloons not rising to the top of the mine, chamber, or passage, and the presence of carbonic acid by their not sinking to the bottom.]

9. H. Johnson. — On a Deep-sea Pressure Gauge. [We have a copy of this paper, and shall publish it in an early number.]

10. Mr. Davies, F.R.S.A., F.L.S.—On a Patent

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Disc Pan for Evaporating Saccharine Solutions and other Liquids at a Low Temperature. [We shall probably publish this in an early number.]

11. Adam Topp.—Various Modes of Fire Escapes, Boats, &c. [This miscellaneous affair has not reached us in any form.]

There were a few papers which will be of interest to our readers read in other sections of the Association; these we shall publish in due time.

ON EXPERIMENTS TO DETERMINE THE EFFICIENCY OF CONTINUOUS AND SELF-ACTING BREAKS FOR RAILWAY TRAINS.

By WILLIAM FAIRBAIRN, C.E., F.R.S., &c.*

Of late years various improvements have been introduced upon railways, to diminish the dangers of travelling, and attention is now specially directed to the increase of the retarding power for trains by various kinds of breaks. From an early period in the history of railways, it was seen that few objects were more important for ensuring the security of passengers, and reducing the loss of time occasioned by stoppages, than the attainment of some means of destroying the momentum of trains with ease and rapidity; that is, in the least time and in the shortest distance. The less the time requisite to break a train, the longer the steam may be kept on in approaching a station and the less is the loss of time in stopping. And the shorter the distance in which a train can be brought to a stand, the less danger is there of collision with obstructions on the line perceived not far off ahead. It is already allowed by many of those connected with railways, and has been expressly stated by the Lords of the Committee of Privy Council for Trade, that the amount of break power habitually supplied to trains is in most cases insufficient, and their Lordships enumerate thirteen accidents from collision occurring in 1858, the character of which they consider would have been materially modified, if not altogether prevented, by an increased retarding power under the command of the guards of the trains.

Upon this subject the most important communication hitherto made has been the Report prepared by Colonel Yolland for the Railway Department of the Board of Trade, and containing a large number of experiments with heavy trains at high velocities. The breaks with which Colonel Yolland experimented were those which, as improvements on the common hand break, have hitherto commanded most success. These were the steam break of Mr. McConnel, the continuous break of Mr. Fay, the continuous and self-acting break of Mr. Newall, and the self-acting buffer break of M. Guerin. The general conclusions to which Colonel Yolland was led by his experiments resulted in the recommendation of the break of Mr Newall; and for heavy traffic, a provisional recommendation of the break of M. Guerin.

From a misunderstanding caused by this Report of Colonel Yolland arose the necessity for some further experiments on the similar breaks of Mr. Fay and Mr. Newall; and these I was called upon to arrange and carry out, by the directors of the Lancashire and Yorkshire Railway. I propose to lay before the Association a brief abstract of these experiments, with some remarks upon the conclusions to which they gave rise.

It will not be necessary here to describe minutely the details of the construction of these breaks. They consist essentially of a series of break blocks acting upon every wheel of the carriages of the whole train or some part of the train, the break blocks being suspended as flaps or placed on side bars beneath each carriage, as in the ordinary arrangement of the guard vans. But whereas it would be both expensive and inefficient to work these breaks with a guard or breaksman to each carriage, both Mr Fay's and Mr. Newall's patents provide for a continuous shaft, carried the whole length of the train beneath the framing, and with suitable jointed couplings between each pair of carriages, so that they may be undisturbed by the rocking motion of the train or the action of the buffers. In this way the whole of the breaks may be worked by a single person at either end of the train communicating his power to each break though the agency of the continuous shaft.

Again, there have been applied, in the first instance by Mr. Newall and subsequently by Mr. Fay, powerful springs beneath each carriage, connected with the arms of the rocking shaft, by means of which the breaks are made to act instantaneously throughout the train, on the release of a catch or disengaging coupling in the guard's van. The value of this provision for the immediate and simultaneous action of the whole of the breaks, in cases where an obstruction is perceived upon the line, will be at once evident. It is one of the most important features of these breaks.

In carrying out the views of the directors of the Lancashire and Yorkshire Railway Company, it was arranged, in order to test the relative efficiency of these breaks, to have a series of experiments upon the Oldham incline of 1 in 27 on this gradient. A train of carriages fitted with Mr. Newall's self-acting slide breaks, and a similar train fitted with Mr. Fay's continuous flap breaks, were started in turn, and after having passed over a measured distance by the action of their own gravity, the breaks were applied, and the distance along the incline in which the trains were respectively brought up was carefully ascertained, as a measure of the retarding force of each. The trains employed consisted of three weighted carriages each, and having been placed upon the incline, they were started by removing a stop. Having then descended a previously measured distance with a uniformly accelerating velocity, they passed over a detonating signal, which conveyed notice to the guard to put on the breaks. Then the train having been brought to a stand, the distance from the fog signal to the point at which the train stopped was measured, and the train brought back for another experiment. In this way it was easy to obtain an initial velocity of 50 feet a second, or 35 miles an hour, before applying the breaks.

Unfortunately the day upon which these experiments were made proved misty and foggy, with rain at intervals, so that the rails were in the very worst condition for facilitating the stoppage of the train. The significance of this fact will be seen on comparing the retarding power of the breaks in these experiments with those made in fine weather.

Reducing the results, we find that the retarding force exerted by each break in terms of a unit of mass, was equivalent to the numbers in the following table:—

EXPERIMENTS ON THE OLDHAM INCLINE.

No. of Experiment.	Mr. Newall. Velocity of train in feet per sec.	Time in stopping in seconds.	Retarding force of break.	Mr. Fay. Velocity of train in feet per sec.	Time in stopping in seconds.	Retarding force of break.
1	25·71	14	1·32	25·71	13	1·91
2	30·00	16	1·63	30·00	13	1·79
3	37·50	17	1·70	37·50	14	1·84
4	42·85	25	1·69	41·37	15	1·76
5	42·85	14	2·01	40·66	12	2·02
6	48·38	19	1·78	48·38	25	1·72
7	52·94	17	2·01	50·00	17	1·91
	Mean...	21·6	1·74	Mean ...	19·2	1·85

The general result of these experiments gives a retarding force of 1·74 lbs. per unit of mass for Mr. Newall's break, and 1·85 for Mr. Fay's. Or, in other words, Mr. Newall's break exerted a retarding force of 121·3 lbs. per ton weight of the train, and Mr. Fay's a retarding force of 129 lbs. per ton.

I afterwards arranged for some further experiments at Southport upon a piece of level rail between that town and Liverpool. The speed requisite in this case had to be obtained by the aid of an engine, which was detached by a slip coupling at the instant of applying the breaks. In other respects these experiments were conducted like the preceding, with fog-signals, and the time noted by stop watches. The weather, however, was in this case fine and dry, and hence the following results were obtained in the most uniform circumstances.

The friction of the train itself, and the resistance of the air, was ascertained to amount with Mr. Newall's train to 6·4 lbs. per ton, and with Mr. Fay's train to 10·4 lbs. per ton.

EXPERIMENTS AT SOUTHPORT.

Slide breaks; Engine detached.

Mr. Newall. Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of break.	Mr. Fay. Speed in miles per hour	Distance of pulling up in yards.	Retarding force of break.
32·72	59¾	6·77	35·29	56	7·97
35·73	77	6·28	43·90	98	7·05
43·90	136	5·08	50·00	129	6·94
46·15	149¾	5·42	54·54	144	7·49
52·94	205¼	4·89	54·54	161¼	6·59
54·54	192	4·66	37·89	97	5·30
47·37	209⅜	.....	60·00	204¼	6·30
58·73	232	5·23	60·00	214	6·03
63·16	273	5·55			
Mean		5·49	Mean		6·70

In this case we have a retarding force per unit of mass equivalent to 5·49 lbs. in Mr. Newall's break, and 6·7 lbs. in Mr. Fay's. Or, in other words, the retarding force of the slide breaks of Mr. Newall, from eight experiments, at velocities varying from 35 to 60 miles an hour, was equivalent to 382·6 lbs. per ton weight of the train. The retarding force of Mr. Fay's slide break from eight similar experiments, at velocities from 33 to 63 miles per hour, was equivalent to 466·4 lbs. per ton weight of the train.

FLAP BREAKS—ENGINE DETACHED.

Mr. Newall. Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of break.	Mr. Fay. Speed in miles per hour	Distance of pulling up in yards.	Retarding force of break.
50·00	132½	6·75	51·43	158¾	5·98
50·00	123	7·28	51·43	162½	5·82
51·43	192	4·93	54·54	184	5·79
Mean		6·32	Mean		5·87

These experiments give for the retarding force of Mr. Newall's flap break 6·32 lbs. per unit of mass, and for Mr. Fay's, 5·87 lbs.

Or, in other words, the retarding force of Mr. Newall's flap break, from three experiments at velocities varying from 50 to 51¼ miles per hour, was equivalent to 440·3 lbs. per ton weight of the train.

The retarding force of Mr. Fay's flap breaks, from three similar experiments, was 408·6 lbs. per ton.

We may illustrate the general bearing of these experiments by estimating from an average of the whole experiments the distance required to stop a train fitted with these breaks, and detached from the engine:—

A train would be stopped at a velocity of

20	miles an hour in	23·4	yards.
30	"	52·9	"
40	"	93·8	"
50	"	146·8	"
60	"	211·5	"

This last table exhibits, in a very clear manner, the advantages of this class of breaks, in which the whole weight of the train aids in destroying the momentum of the mass instead of the weight of one or two guard vans only. It may be impossible in long trains to apply these breaks to every carriage; but at all events, in the ordinary traffic, three times the present amount of break power may be employed with ease.

On the score of economy, also, the system appears to encourage its application. From experiments which have been made it appears that the wear of the tyres is far more uniform and equal, because the springs may be so adjusted as not to cause the wheels to skid. The manager of the

*A paper read to the British Association, 1859.

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East Lancashire Railway states that with two trains running together between Salford and Colne, the carriages fitted with continuous breaks travelled 47,604 miles before the wheels required turning up; whilst an ordinary break van, running the same distance, had to have its wheels turned up three times in the same period, three-eighths of an inch being taken off each time.

EXPERIMENTS AT SOUTHPORT.

Engine not detached from the trains.

Mr. Newall.		Mr. Fay.		Remarks.
Speed per hour.	Distance of pulling up.	Speed per hour.	Distance of pulling up.	
Miles.	Yards.	Miles.	Yards.	
33·96	124½	31·8	121½	
37·11	169½	33·96	137	Engine and tender.
41·86	221	41·86	193½	Tender break appld.
		51·43	274	Tank engine.

It will be observed that on most through lines that the trains travel on some portion of the distance at the rate of 60 miles an hour; and in the event of an obstruction half-a-mile in advance a collision would be inevitable unless the driver has the power and the presence of mind to act with promptitude. Now, at 60 miles an hour there is only 30 seconds, or half-a-minute, to effect that object, and it is quite impossible to apply the breaks in their present state before the train—in such a precarious position—is in actual contact. Assuming, however, that breaks upon the principle of Newall and Fay were attached to the engine as well as the train, and that the driver had the power of instantaneous application by liberating a spring, it is evident that instead of the train dashing forward to destruction, the momentum might be destroyed in a distance of less than 500 yards, and that without injury to life or property. Besides, the application of the electric telegraph, which prevents on most through lines more than one train being on the line between the stations, is a great additional security, and that united to the continuous break *applied to the engine as well as the train* would, when united to a more perfect system of signals, render collision next to impossible.

ON THE SUPPLY AND PURIFICATION OF WATER.

By Thomas Spencer, Esq., F.C.S., &c.*

The author of this paper set out by stating that from an extended practice for a number of years in relation to the chemistry of water for the supply of towns, he became convinced that the available quantity of pure water in these islands was decreasing, whilst it was evident the demand for this primary necessary of life was undergoing an annual increase. In short, that in the more cultivated districts the supply was every year becoming less capable of meeting the demand.

From continuous personal observation of many of the water-bearing districts of Great Britain, he had now found many shallow springs dried up, or gradually becoming so, whilst the beds of small streams, where water was formerly known to flow pretty regularly, were almost dry, except in times of flood. This had a corresponding effect on the depth of the water of most rivers, but was especially felt of late years in those that were navigable.

The bearing of this state of things on our available water was to increase the quantity of its *organic impurity, inversely* with the amount of its supply. These *effects* he would show were chiefly due to increasing drainage.

An additional and most important source of the impurity of river water arose from the now legalised efflux of excremental matters into common sewers, and thence into rivers, by which they were rendered equally fertile sources of disease to the cesspools they had superseded. In short, wherever population was, running waters were becoming more and more polluted with the matters which formerly went to maintain the fertility of the soil. Nor was it necessary to remind the members of that section that agriculturists had to resort to another hemisphere to make up the deficiency. So obvious had this evil become, that the aid of chemistry had been universally called for to devise some means of entrapping the riches which were thus squandered in the ocean.

Although prophecies as to the results of contemporaneous operations were attended with considerable risk, yet he would venture to predict, that the chemical efforts now being made to utilise sewage matters must prove abortive, simply because they were commenced at the wrong end of the sewer. That modes were known to chemists fully equal to the extraction of all the nitrogenous and phosphoric constituents of diluted sewage, there could be no doubt.

The real question, as regarded any of these operations, was not as to whether it *could* be done, but whether, when done, the products would repay the cost of obtaining them—a consummation which was far from probable. At the same time the chances of success would be found much greater if the attempts to utilise these matters were undertaken at less distance from their source, and previous to what he regarded as their *destructive dilution with water*. As it was, however, this had the effect of causing the inhabitants of towns to resort to distant quarters for water, to replace that which they formerly obtained in sufficient abundance from the rivers.

As already stated, shallow springs were becoming extinct, whilst supplies from wells could only be obtained by carrying them to greater depths, and those had to be sunk far apart, to ensure an extended conoid of percolation. Mr. Spencer then proceeded to show that the causes of this general diminution of spring water was almost entirely due to the vastly increased drainage that had taken place of late years. The greater part of the rain that was formerly allowed to percolate the substratification, and thence issue at lower levels as spring water, was now carried off the land by means of deep drainage, and drain pipes, into the adjoining brooks in a few hours. The contrast between this and the former state of things was described as being not unlike that witnessed after rain had fallen on two roofs, the one thatched, the other slated. For hours after the last shower water trickled from the eaves of the thatch, whilst a few minutes served to obliterate all traces of moisture from the slates.

But in addition to this, the same condition of things had the important effect of diminishing our rainfall as well, so that not only was it rapidly carried off the land, but as a direct consequence, every year drainage had less water to deal with. This result arose as follows:—The larger amount of dry surface resulting from excessive drainage had two distinct effects, each dependent on the other. One was to diminish the amount of evaporation, and thereby cause fewer clouds, whilst the same absence of moist surfaces prevented clouds from other quarters being attracted, consequently their aqueous contents were not so liable to be discharged on the now well-drained tracts as formerly.

Though the operation of these circumstances on our climate was described at considerable length, yet this part of the subject was alone so extensive as to cause the author to leave many important points untouched. In concluding the first part of his communication, that he might briefly exemplify the principles he had set forth, Mr. Spencer put it to his auditory, if, when speaking of formerly moist or ill-drained districts in recently discovered tracts, they did not constantly hear of the *meliorating influence* which had been effected on climate by cutting down forests, and draining marshes, and, *was not this always followed by a lessening of rainfall?* And again: if these sources of evaporation were thus cut off, was it not obvious that the natural process of cloud-forming must to that extent be decreased, and therefore less rain be likely to fall? Besides, were not most observers agreed in opinion, that clouds are attracted wherever there is wide-spread moisture, and as a consequence, is their rain not discharged more abundantly and frequently at those parts of the surface, than where moisture to the same extent does not exist?

In corroboration of what had been stated, he added, that the most reliable meteorological observations of the last forty years exhibited a continuous decrease of rainfall, at least in the more southern parts of this island; whilst during the same period the extent of the drainage area had been steadily advancing. The author had no intention of doubting that the benefits of improved drainage were of a high character, and almost equally so those arising from the absence of accumulations of filth near our dwellings. Both were the inevitable results of our advancing civilisation, though each might be made to undergo some wholesome modification. Meanwhile, great as their benefits undoubtedly were, his present object would be attained if he succeeded in calling attention to the vast though hitherto overlooked cost at which they were obtained.

His opinions as to the results of drainage, together with the probable effects of sewer water on the quality of our domestic supply, were first published by the author in 1846. Since that period all his very ample opportunities for practical observation have added certainty to the opinions he had then set forth. It being thus evident that the quantity, as well as the general quality of our water supply was rapidly deteriorating, it struck him that some efficient and cheap mode of effecting its purification would be attended with great public benefit. Accordingly, in 1854, he began to devote himself to the subject, which he had now brought, he trusted, to a successful issue.

At the commencement of his researches, the opinions of all the authorities with regard to the probability of purifying water by artificial means, were summed up at the conclusion of the report drawn up by the Government Commissioners, "On the supply of water to the Metropolis." These gentlemen there said:—"That water cannot be deprived of matter *held in solution* by any practical modification of the process of filtration." This was the state of the subject when entered on by him. His object, from the beginning, was to discover the mode by which nature converted impure coloured surface water into colourless spring water, the operation being apparently one of filtration. His first experiments were made with a view of throwing some light, if possible, on the philosophy of filtration as ordinarily practised, he having some reason to believe the process, when most effective, did not so much depend on mechanical principles as was generally supposed. To determine this point, a long series of very interesting experiments were related, which resulted in showing that properly conducted filtration (*i.e.*, where the gravitating power of the water is not in excess) is dependent on a lateral attractive action exercised by the sand or other media through which the process is performed, this being in addition to the downward action of gravitation. His next object was to discover what bodies in nature exercised this newly-discovered attractive power the best. After trying a number of experiments with various descriptions of rocks and minerals, all of which were described to the section, he found that those containing protoxide of iron (even where it was chemically combined with other substances) effected the filtration of water better than any other. Acting on the idea thus suggested, he found the same oxide, when isolated in the state of "magnetic oxide," not only to free it from turbidity more effectually than an equal thickness of sand, but to effect its decolouration with marvellous rapidity: whilst the other earthy substances entering into the composition of the same rocks, such as silica and alumina, were, in the latter respect, perfectly *inert by themselves*. From this it appeared evident that the protoxide of iron—as magnetic oxide—a substance which enters into

* The British Association, September 17th. Section B.—Chemistry. President—Dr. Lyon Playfair, C.B., F.R.S.

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the composition of so many rocks, was one of nature's chief agents of purification. Here the author referred to a series of experiments he had made, showing that the commonly received opinion, that light and air *alone* effected the purification of water, was erroneous. For example, he had put coloured bog water into shallow glass pans, in which it was fully exposed to both these agencies for several weeks—evaporation being compensated by distilled water—but without any change being apparent in its colour. This result, so contrary to what might have been expected *à priori*, led him to refer the natural process to the agency of some other body which probably exercised a catalytic action on the atmospheric oxygen, and thereby induced this gas to combine with the noxious impurities existing in the water. Nor was he mistaken in this surmise, as the rasults so amply related in the paper, together with the experiments, exhibited to the section, sufficiently attest. A very striking one was made with some bog water, much darker in colour than ordinary porter, which had been procured from the soakings of an Aberdeenshire peat bed. This water *was deprived of colour almost instantaneously* by mere contact with the oxide.

To appreciate this result it is to be remembered that no known agency has been able to effect a similar one before. Since soft water has become so much an object for manufacturing purposes, to effect the decolouration of that of bogs had remained a problen unsolved by chemists. Not only was it now evident that this water could be deprived of all trace of colour, but it was rendered bright, clear, and perfectly free from taste. Several who partook of it pronounced it to be equal in these respects to spring water. Above all, the means by which the charge was effected were so exceedingly simple. For example, the coloured water was poured into a glass vessel containing a layer of about five inches of equal parts of coarse sand and a hard ferruginous substance, perfectly magnetic, on which the water issued forth with great rapidity, perfectly colourless.

The action of the oxide, however, was far from being confined to the decolouration of bog water; that experiment had only been brought forward because it could be strikingly exhibited to a public assembly. On the contrary, it equally affected every impurity to which water was subjected—even that of the London sewers had been rendered harmless, and void of all odour and taste by the same means. Besides which, it had resulted from the experiments of Professors Brande and Clark, that soft water treated by the magnetic oxide had no action on lead.

Perhaps the most extraordinary circumstance was, that *the magnetic filtering medium itself suffered no deterioration after any period of operation*. Its province was confined to forcing the oxygen resident in the water into combination with the colouring matter, and thus converting it into carbonic acid, which gas, it need hardly be said, conferred freshness and salubrity on all waters in which it was found. In this result the occult action of catalysis was, for the first time in the history of science, brought at will into useful every-day operation: in explanation of this extraordinary action, the author now entered at some length on the received notions of what was really to be understood by the term "catalysis." He thought it might be satisfactorily shown that the substances inducing this action did so in virtue of their power to alter the molecular arrangement of the bodies they acted upon—as a magnet alters the arrangement of iron filings, even at a distance. He believed he was in a position to show, however, that the phenomenon was strictly identical with electro-polarisation.

In the experiment he had exhibited, there could, he believed, exist no doubt that the magnetic oxide of the filter had the power of attracting oxygen to its surface, and when there this gas necessarily became polarised. Whilst in that state, and *only whilst in that state*, it combined with the organic colouring matter to form a new substance. But the most startling circumstance he had to relate was, *that the oxygen when in this state of polarity was neither more nor less than ozone*—that fugitive body, of hitherto doubtful origin, which had become so much identified of late with atmospheric salubrity. This novel proposition was illustrated by an equally novel and certainly most convincing experiment, as far as it went. We are unable to give its details farther than by stating that it exhibited a larger amount of oxygen converted instantaneously into ozone by the action of the magnetic oxide, on an alcoholic solution of gum guiacum, than, perhaps, had ever been witnessed in the same compass before. Though the President evidently had not leant to the author's theory, this unlooked for proof of it elicited his admiration. Mr. Spencer stated, however, that this was only one among many modes he possessed of demonstrating the same fact, viz.:—that ozone was polarised oxygen.

For example, a still stronger proof was cited, viz.:—that the poles of a galvanic battery immersed in the guiacum solution of alcohol produced ozone in the same manner, *but only at the oxygen pole*. But what he ventured to believe amounted to a confirmation of this view was, that a similar effect was that the battery did *not* produce this effect in a solution with absolute alcohol; water was therefore essential in order that its oxygen might undergo polarity, or in fact, ozonification. Mr. Spencer further stated, that according to his experiments, he had found most natural substances that contained protoxide of iron exercised this power of ozonifying oxygen. Even if this now important oxide was locked up in chemical combination with other bodies, still the power was more or less exercised through the solid covering. The existence of ozone in the atmosphere, therefore, need be no longer a problem. He had proved by his experiments, that air whilst passing over substances of this character became ozonified by contact alone. Henceforth we could account for the salubrity of some winds as compared with others. It would now be evident that the adventitious electricity of thunder storms had but a small share in producing ozone in sufficient quantity for the purposes of nature. But the ferruginous suboxide was not the only one that exercised this important function, as several other metallic sub-oxides which he enumerated partook of the same power, though in less degree. Per-oxide (ordinary rust), on the other hand, or metallic iron, was perfectly inert. He also found that several gum resins exercised a similar power, though in lower degree, over oxygen.

Mr. Spencer now gave an account of a new compound magnetic body which he had succeeded in making to better enable him to carry out the purification of water on a large scale. Though the magnetic oxide he had first obtained from the white carbonate of iron was very effective, yet it had a tendency to be reduced to powder by attrition. He became apprehensive therefore it might ultimately interfere with the rapidity of his filtering operations. This led him to seek some mode of procuring a harder and less friable body. After various experiments he had been successful beyond his anticipations. By very simple means he had formed a magnetic body from the hitherto refractory Cumberland hematite. The new substance consists of iron, oxygen, and carbon—an equivalent of each—its atomic number is therefore 42. Specimens of the new body were exhibited to the section. It appeared very hard, and when polished had a black metallic lustre. It was said to be as incorrodible as gold or platinum, and is highly magnetic. Its purifying powers were stated to be very great. It can be manufactured very cheaply. Mr. Spencer, as its discoverer, had named it protocarbide of iron.

The President (Dr. Lyon Playfair), at the close of the paper, was sure the section would feel much indebted to Mr. Spencer for the valuable nature of the practical results he had laid before them. Though much struck with the ozone-forming experiment in support of the theory, yet he, the President, hardly felt himself at liberty to give his adhesion fully regarding this view of the nature of ozone. There was another mode of testing the matter, however, which he named, and which, if successful with the magnetic oxide, might carry more conviction to his mind. Mr. Spencer stated that he had not considered the mode named by the President as being so good a test of the presence of ozone as the one he had brought before the section.

At the following meeting of the section, however, this experiment was successfully performed by Mr. Spencer, in the presence of the President, thus affording an additional proof that ozone is only polarised oxygen, and that nature is not confined to one mode for its production.

Copious as this abstract appears, yet we have been obliged to omit several equally interesting topics embraced in the original paper.

COAL-BURNING LOCOMOTIVES.

"D. K. CLARK'S SYSTEM OF COAL-BURNING WITHOUT SMOKE, BY THE METHOD OF STEAM INDUCTED AIR-CURRENTS, APPLIED TO THE LOCOMOTIVE ENGINES OF THE GREAT NORTH OF SCOTLAND RAILWAY."

By Daniel Kinnear Clark.*

The substitution of coal, as fuel, for coke in locomotives, is not only felt to be a commercial necessity for the reduction of expenditure, but is also discovered to be perfectly practicable as a mechanical problem in conformity with the conditions laid down by the railway Acts of Parliament that railway engines shall consume their own smoke. The means of doing so, to be adaptable to a locomotive engine, must be simple in design, facile of application to existing locomotive stock, easy to manage, easy to maintain, efficient in promoting the combustion of coal without smoke, keeping up the steam, and saving expense.

These desirable qualifications the writer believes belong to this system of smoke prevention. The whole apparatus is external to the fire-box, and therefore not exposed to heat; and it is controlled in the most perfect manner by a single stop-cock. Air is admitted above the fuel by one or more rows of tubes inserted through the walls of the fire-box, and jets of steam are projected through the air-tubes from nozzles ⅛th inch diameter, in small steam pipes, placed outside the fire-box, to increase the quantity and force of the air admitted above the fuel in order to consume the smoke. The jets of steam are used principally when the engine is standing, with the aid of a light draught from a ring-jet in the chimney, to carry off the products of combustion, and they may be shut off when not required. The supply of air through the tube may also be regulated by dampers.

The grate-bars are placed close together, with narrow air spaces, and the ash pan and damper are lightly fitted. The level of the fuel should at all times be below the air-tubes.

This system is working with entire success on the engines of the Great North of Scotland Railway, at Aberdeen. It is also successfully at work daily (amongst other lines) on several of the engines of the North London Railway, where, as a Metropolitan line, the regulations against smoke nuisance are rigidly enforced. It requires a less weight of coal than the engines formerly required of coke for the same duty; and thus saves more than the whole difference in the price of the two fuels.

The locomotive engine has been variously cut up and mangled in order to suit the views of designers for the combustion of coal without smoke. In the plan before the meeting, the original type of engine promulgated by Mr. Stephenson, and at this day universally adopted and unsurpassed, is preserved intact; and the locomotive is thus rendered a complete and perfect machine, and entirely meets the great railway necessity of the day—the perfect combustion of coal in railway engines.

* British Association, 1859.

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Literature.

Our Engines of War, and How we Got to Make Them. By Capt. Jervis-White Jervis, M.P., Royal Artillery. London: Chapman and Hall, 193 Piccadilly. 1859.

As a rapid superficial sketch of the progress made in the production of great and small guns this work has many merits, although its title is undoubtedly too comprehensive and its price too high. The author, known before for his "Manual of Field Operations," his treatise on "The Rifle Musket," and his speeches in Parliament on similar subjects, here gives us only a hundred and eight small pages of matter in very large type, and it is hardly fair, we think, to the reading public to label such a *brochure* with the broad and sounding title, "Our Engines of War, and How we Got to Make Them," and to charge six or seven shillings (as is done, if we remember rightly) for it. Many of our engines of war are not mentioned at all in the book, and others are passed over very lightly indeed. It is the publishers, however, we presume, rather than the gallant author, who are responsible for the price and title, and it is as a warning to them that we express dissatisfaction on these points. In other respects they have turned the work out of hand very satisfactorily, the type, wood cuts, &c., being of the best kind.

It is due to the author to say that he has made his work very interesting, and has displayed great intelligence in dealing with the various subjects that he has considered. Nor can we refrain from congratulating the public upon the excellent temper and wisdom displayed in the work. There is no jealousy of inventors, no distrust of non-professional men to be found in it; but on the contrary a sound spirit of progress, and a hearty love of improvement manifested throughout. When we remember that the author holds a high military office—that of superintendent of our small arms department—we cannot but hail such evidences of enlightenment with pleasure. Nor is Captain Jervis alone in this respect. From a report which appears in another page it will be seen that Colonel Dixon, who has charge of the works at Enfield, has just been evincing a similar spirit in connection with the Association of Foremen Engineers. We gladly accept such facts as proofs that the old and bad feeling of military exclusiveness, which has cost us so much, is declining, and as omens of its speedy and complete extinction.

The Journal of the Royal Agricultural Society of England. Volume XX., Part I. 1859. London: John Murray, Albemarle-street.

This journal is very high-priced, but it is worth all that is charged for it. In the present part we have no less than fourteen articles, some of them of a most valuable nature. Those on the preservation of timber, the application of liquid manure, American methods of economizing labour, and the cultivation of land by steam, deserve the special attention of our readers.

The Drawing-Room Portrait Gallery of Eminent Personages. With Memoirs by the most able Authors. 1859. Second Series. The London Joint Stock Newspaper Company (Limited), 199 Strand; West-end Branch, 122 Regent-street.

Without the slightest approach to exaggeration it may be said that a book more suitable for a drawing-room table than this does not exist. It contains portraits of at least forty of the most notable persons of the day—statesmen, clergymen, engineers, artists, orators, singers, and so forth; and such portraits as never could be obtained until now at any price, and even now can be obtained nowhere else for twenty times the sum for which they are here supplied. The highest photographic art has guided the highest art of the engraver in their production, and hence we have a result which is both splendid and unique. If the price were many times what it is we should recommend every reader of ours who can afford to put a handsome book on his drawing-room table to put this (and the previous volume likewise) there.

The Theory of Compound Interest and Annuities, with Logarithmic Tables. By Fedor Thoman, of the Société Crédit Mobilier of Paris. London: Lockwood and Co., Stationers'-hall-court. 1859.

This is a very ambitious book of its kind, and bears evidence of great research. Fortunately it does not lie within our duty to examine deeply into a financial work, but we may nevertheless say that we have taken the trouble to go through some of M. Thoman's mathematical investigations, and to glance generally through the book, and our impression is that he has produced a very original and valuable work. Professor De Morgan, who speaks with some weight on such a subject, and who has looked into the volume, thinks highly of it.

Mr. Goldsworthy Gurney's Account of the Invention of the Steam-jet, or Blast; and its Application to Steam-boats and Locomotive Engines. London: S. Barclay, Castle-street, Leicester-square. 1859.

Mr. Goldsworthy Gurney here claims for himself an invention which Mr. Smiles has attributed to the late Mr. George Stephenson, and claims it, as we think, with much apparent reason.

LIST OF NEW BOOKS.

Aston's Income-tax Tables, New Edit., 3s. 6d.
Blenkarn's British Timber Trees, 5s.
Clegg, on The Manufacture of Coal-Gas, Third Edition, 31s. 6d.
Kennedy's Notes on the Defences of Great Britain, Fourth Edition, 2s. 6d.
M. Ewen's Culture of the Peach and Nectarine, 3s. 6d.
Turner's Domestic Architecture in England, Vol. III., 30s.
Wilson's Our Farm Crops; Part I., Wheat Crop, 1s.

THE PROGRESS OF STEAM NAVIGATION AT HULL.

By James Oldham, Esq., Hull, M.I.C.E.*

For generations past Hull has been noted for its Greenland and Davis Straits fishery, and for many years this has constituted the chief feature of the port. Within the last two or three years steam has been put into successful requisition to aid the dauntless and hardy mariner in the pursuit of this hazardous calling, and now we have several screw steam-ships employed; and although some of them are fitted with comparatively small power, they have proved to be possessed of great advantage in the service, and in some instances satisfactorily to the owners. We have had two descriptions of steam vessels employed in the fishery; the first, the old wooden sailing ships, which had been engaged in the service for some years, but which were afterwards fitted with screw machinery and auxiliary steam power. The second, iron built ordinary screw steam-vessels; but which proved, I believe, almost a total failure. The material of which they were built, and the want of strength for such a purpose, proving them altogether unfit to contend with the severity of the climate and rough encounters with the bergs and fields of ice, some becoming total wrecks, while others returned bruised and rent, and were with difficulty kept from sinking. A question here arises how far iron ships are calculated to bear the severe frosts of high latitudes, and whether wooden-built vessels, with all their defects, are not the best adapted for encountering such a climate? The screw steam-ship which was first sent from Hull, or any other place, to the fishery as an experiment, was the Diana, timber built, 355 tons and 40 horse-power, high pressure, the property of Messrs. Brown, Atkinson, and Co., of Hull. This vessel had been some time engaged in the fishery as a sailing ship; but her spirited owners, thinking an important advantage could be gained, determined upon the adoption of steam power, and at once had the Diana fitted for the spring of 1857 by Messrs. C. and M. Earle, who put in the engines, and made the screw to lift out in case of need. The experiment fully answering their expectations, Messrs. Brown, Atkinson, and Co., bought the Chase, a fine American built ship of immense strength, and of 558 tons. She was fitted by Messrs. Martin, Samuelson, and Co., with condensing engines of 80-horse power, and despatched to the fishery in the early part of 1858, and with good results. By the application of steam, ships in this service can now make a voyage first to Greenland, and afterwards to the Davis Straits. In the commencement of this year several ordinary iron screw steamers were despatched to Greenland, viz., the Corkscrew, Gertrude, Emmeline, and Labuan, the latter only of this class, which is the property of Messrs. Bailey and Leetham, had any success; but in consequence of her great strength and peculiar form, succeeded in a tolerable way; the others were much damaged, and, as I have already remarked, returned in bad condition. The Labuan is 584 tons burthen and 40-horse power.

The next point of interest connected with the steamships of the port of Hull refers to alterations made in some of the vessels. The Emerald Isle, a paddle timber-built ship of 1835, the property of Messrs. Gee and Co., originally 135½ long, lengthened 35 ft., with a gain of 14 in. draught of water, and an increased capacity for 100 tons dead weight. The Sultana, iron screw steamship of 1855, the property of the same house, originally 150 ft. long, lengthened 30 ft. with a gain of 10 in. draught of water, and an increased capacity of about 100 tons. It is interesting to observe that in both cases we have no diminution of speed through the water, and that both vessels are improved as sea-boats. Daily experience teaches the advantage gained, in almost every point of view, by ships of great comparative length. The iron steamship Lion, of Hull, formerly a paddle-boat 219 ft. long, but now converted into a screw steamer by her owners, Messrs. Brownlow, Lumsden, and Co., under the direction of Mr. Anderson, their engineer, exhibits the great advantage gained by the alteration. Her register tonnage is 690, and the total tonnage 1,014. She was formerly fitted with steeple engines of 350-horse power, and had four boilers, two before and two abaft the engines; but these were subtituted for direct action engines of 150-horse power, and two of her old boilers replaced, and by this alteration a clear length of hold in midships of 23 ft. is gained. She required before the conversion 650 tons of coal for a Petersburg voyage, and consumed 30 cwt. to 40 cwt. per hour; but now 350 tons for the voyage, and a consumption of 20 cwt. per hour. By the change of machinery about 130 tons of dead weight is removed from the ship, and she is now able to carry 400 tons more cargo. Her speed is also improved considerably; before the alteration, when drawing on an average 14 ft., the rate was six knots and a-half, but since the change, when drawing even more water, they can steam eight knots. Thus throughout a saving almost in all the departments of the ship, and other advantages, have been effected in this important change. During the last two years many fine steamships have been built in Hull, and others are in process of building for English and foreign service by Messrs Brownlow, Lumsden, and Co.; Messrs. C. and W. Earle, and Messrs. Martin, Samuelson, and Co. The last-named firm are making rapid progress in the building of two large paddle steamships for the Atlantic Royal Mail Steam Navigation Company of the following dimensions, power, &c.:—

	Feet.
Length between the perpendiculars ...	360
Beam moulded	40
Depth	30
Tonnage, builder's measure...	2,860
Nominal horse-power	800

These ships are to have three decks, and to be fitted fore and aft for passengers. Speed through the water, twenty miles per hour. They will be of immense strength, and their build and form such as to ensure their becoming fine sea-boats.

Since the meeting of the British Association, at Dublin, considerable advance has been made in London and other ports in the application of superheated steam, and, I believe, with great success and satisfaction in the results; Hull, however, before taking a decided step in this important discovery is anxious to see and adopt the best mode of the application of the principle, being assured

* British Association, 1859.

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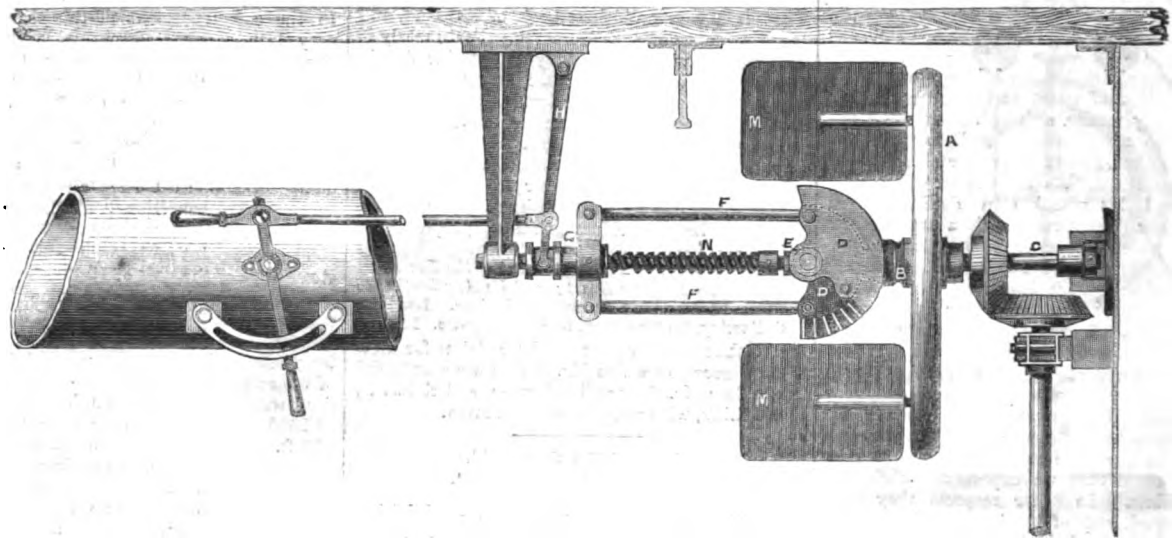
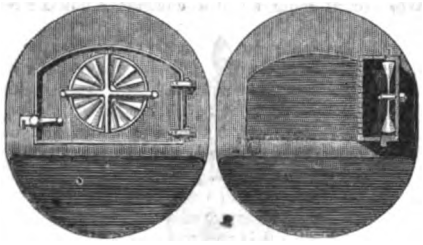
SILVER'S PATENT MARINE AND STATIONARY ENGINE GOVERNORS.



that in every onward movement it is better "to make no more than good speed." Some attention has been paid to the consumption of smoke in the furnaces of our steam-vessels, and with a considerable amount of success. I may here mention the mode of Mr. Ralph Peacock, of New Holland, Hull, for which he has taken out a patent. It consists of a double furnace-door (two views of which are shown in the annexed engraving), the



chamber or space between the inner and outer surfaces being five to six inches in width. The inner plate is perforated very full of small holes, and in the outer plate a revolving ventilator is inserted, which is on the principle of that invented by Dr. Hale, to supply close places with fresh air. The apparatus is in use on board the Helen Macgregor, one of Messrs. Gee and Co's. large sea-going steam-ships, and has given very general satisfaction, for by the report of the chief engineer, Mr. McAndrew, a saving of fuel is effected and the steam better sustained. Another great advantage, as reported by the master, Captain Knowles, derived from this invention is, that on running before the wind, they are never now annoyed and endangered by a dense cloud of smoke in the direction of the ship's course, which, particularly at night time, creates so much risk of collision. This apparatus is also in use on board several other steamers, viz., the Yarborough and Grimshaw, belonging to the Anglo-French Company, the Albert, of Hull, and also a number of river steam-boats. I have great pleasure in noticing also an improvement introduced on board the Queen of Scotland, another ship belonging to Messrs. Gee and Co., for the same object, by the chief engineer, Mr. Smith, and having furnaces of ample capacity, answers the purpose in a most satisfactory manner. Mr. Smith's mode consists simply in keeping a few inches off the front ends of the bars quite clear and clean from side to side of each furnace, thus admitting at the right place a sufficient amount of air. The report of the master, Captain Foster, is very satisfactory; I have witnessed also the effect of this mode on the furnaces of stationary boilers with perfect results.

I have now to refer to the application of Silver's Marine Governor as applied by Mr. John Hamilton, of Glasgow. Several of these ingenious and efficient instruments are now in use on board steam-ships in the port of Hull, giving the highest satisfaction. They are so sensitive in their action, that the slightest pitching motion is at once indicated, and the steam admitted or excluded as the case may be. By the use of this governor (which is illustrated in the annexed engraving), the full power of the engines is in immediate and constant requisition, producing the effect of saving of time, saving of fuel, and preventing of accidents by what is termed racing and otherwise. The ordinary mode, in the absence of the governor, is for the engineer in stormy weather and heavy seas continually to stand at the throttle-valves, or, to save himself this trouble, to throttle the engines, and thereby when the full power of the engines is most required, it is frequently reduced to one-half or less, and consequently there is occasioned a loss of time on the voyage, and the risk of falling on to a lee shore.

SILVER'S PATENT MARINE AND STATIONARY ENGINE GOVERNORS.

Constructed by John Hamilton, Engineer, Glasgow.

The engraving represents the Momentum Wheel Governor or "Nautical Regulator," as it is usually placed in the engine-room of a steam-ship. It consists of a momentum wheel *A* fixed on the boss of a pinion *B*, which works loosely on the spindle *C*, and gears into the two-toothed sectors *D D*. These two sectors being supported on a crosshead *E*, made fast to and carried with the spindle *C*, work in opposite directions on the pinion *B*; and as they are linked by the rods *F F* to the sliding collar *G*, which receives and works the forked lever *H*, communicate motion to the throttle valve. *M M* are vanes, and *N* is a spiral spring, both of which are adjustable.

The action of the above instrument is as follows:—When the spindle of the governor or "Nautical Regulator" is turned by the engine to which it is attached, the two-toothed sectors, which are carried on the fixed crosshead, being geared into the pinion on the momentum wheel, have the tendency to turn round on this pinion; but as they are linked to the sliding collar, they necessarily pull inwards this collar, and so compress the spiral spring, and this spring reacting on the collar, and consequently on the toothed sectors, serves to turn round the momentum wheel, while the vanes on the momentum wheel balance the action of this spring by the resistance the atmosphere offers to their progress through it. As the leverage action of the toothed sectors upon the momentum wheel pinion increases as the spring becomes distended, and *vice versâ*, it will be seen that the reaction of the spring in propelling the momentum wheel will at all times be uniform, and as much only is required as will carry round the momentum wheel with its vanes at its proper speed, and overcome the friction of working the throttle valve and throttle valve connections. When the momentum wheel is in motion, it will rotate with the engine to which it is attached at a velocity proportioned to that at which it is fixed by the connecting gear; and while the engine from the usual causes may attempt to vary this velocity, it cannot affect the momentum wheel, but leaves it free to act upon the sliding collar, and consequently upon the throttle valve—at one time closing the throttle valve by its action in resisting any increase of velocity, and at another time opening the throttle valve by its action in resisting any decrease of velocity on the part of the engine. It will now be evident that the power of such a governor or regulator must be very great indeed, having for its agent a momentum wheel which may be increased to any dimensions, and from the powerful resisting tendency of such wheel, it necessarily follows that its sensitiveness of action must also be very great, and in exact proportion to the tendency of the engine to vary its speed; and the engine itself being the direct prime mover of the throttle valve, it also follows that the inert power of the momentum wheel increases its resistance exactly in proportion to the rapidity with which the engine varies its speed. Hence, a momentum wheel of two feet eight inches diameter, and two inches periphery, running at a speed of 180 revolutions per minute, is found to be sufficient to work with promptness and ease the largest throttle valve, and to equal the power of several men. Unlike the ordinary forms of governors, it is entirely unaffected by changes of position, and therefore perfectly adapted for marine and portable, as well as stationary steam-engines.

The continental papers state that preparations are being made for an Agricultural Exhibition in St. Petersburg in September, 1860.

During the past week no fewer than 40 total wrecks have been posted on the books at Lloyd's. Among the more calamitous were the destruction by fire of the ship Schah Jehan. She was bound from Calcutta to the West Indies, and had on board 300 coolie emigrants. For four days every effort was made to save the ship and the unhappy creatures on board, and ultimately three rafts, crowded by 300 souls, were set adrift, and have never since been heard of. The masters, officers, and crew, about 60, were picked up in a very distressed condition, five days after, by the ship Vasco de Gama. There are, in addition, several missing vessels, respecting which the most painful forebodings are entertained.

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DENNYS' LIFE BUOY.

FIG. 1.

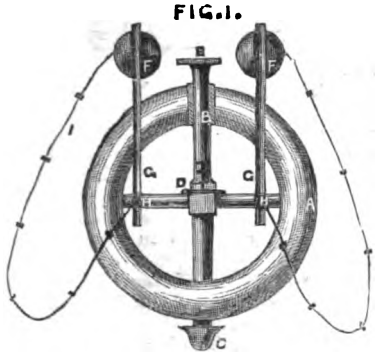
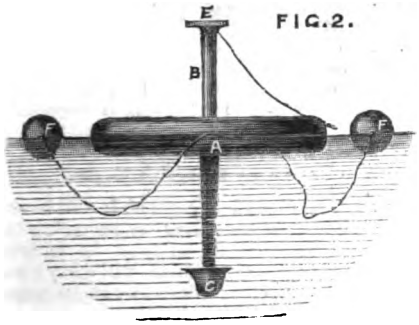


FIG. 2.



Mr. Dennys, Clerk of H. M. ship Britannia, at Portsmouth, has invented a new description of life buoy, which appears to possess some decided advantages over the ordinary buoy used in the navy. Instead of the two hollow copper spheres connected by a cross-bar as used in the old life buoy, Mr. Dennys adopts an annular float, within which the balance bar works by a very simple and ingenius arrangement, the whole of which affords greater facilities for the immersed person to get a firm hold of the buoy, and, by saving exertion, of course prevents exhaustion of strength, and thus enables the person to sustain himself longer than he otherwise could do.

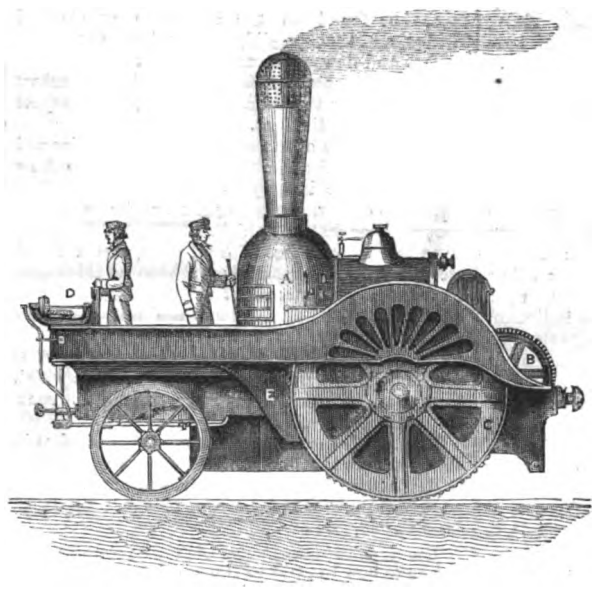
Mr. Dennys' plan has been examined by several experienced naval officers, who have expressed themselves well pleased with it, and it will doubtless be brought to the notice of the authorities.

The following is a description of Mr. Dennys' life buoy by the inventor:—

"This invention consists of a hollow copper buoy with a suspended stanchion in the centre to support the light. Two indentations, one on the upper and the other on the under surface of the buoy, and opposite each other, allow this stanchion to assume a perfectly horizontal direction to the plane of the ring when suspended; on being let go it becomes perpendicular, and is locked in that position by a catch. It is nearly impossible to capsize this buoy. Hollow copper balls suspended on the same guides or on others at the ship's quarters, connected with the buoy itself by floated lines, give an additional chance of safety to a drowning person, as, even if ten or twelve feet distant from the buoy, he may manage to draw himself to it by their aid. It may either be fired in the usual way, the present guides, slip, and percussion hammer being retained; or a friction tube may be used, firing the fuze by the weight of the buoy on being let go. Kisbee's reed life buoys may be fitted on this principle with little trouble. W. B. Dennys."

Explanation of Diagrams.—Fig. 1 shows the buoy at the ship's stern; Fig. 2 shows it afloat. *A*, hollow copper buoy; *B*, stanchion supporting light; C, weight to balance light; *D*, catch to secure stanchion in a perpendicular position; *E*, plate for the fuze and light; *F*, hollow copper or cork balls; *G*, guide rods; *H*, rings for guide rods; *I*, lines floated with corks attaching balls to buoy.

TAYLOR'S PATENT STEAM ELEPHANT.



The subject of steam traction on common macadamised roads and over soft ground, is now engaging the attention of the public. Taylor's patent steam elephant, a side elevation of which we here give, is a very compact and well-arranged machine for the purpose. It consists of a tubular boiler 4 ft. 8 in. long, with the fire placed in a flue, and the flame returns through a number of tubes to the chimney, which is situated at the same end as the fire-door; by thus shortening the boiler there is no fear of any of the tubes becoming uncovered during the course of the engines up steep inclines. The furnace is also adapted to the burning of wood, and is fitted with a simple smoke-consuming apparatus. The funnel passes through the dome of the boiler, so as to superheat the steam, and is provided with an efficient spark catcher.

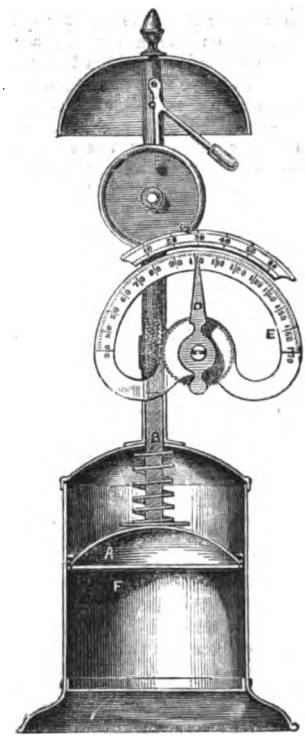
It will be seen on reference to the engraving, both engineman and steerer stand in front of the engine, which is without doubt their proper position, and both fuel and water sufficient for a distance (with a load) of about fifteen miles, are stowed away in a very compact manner. The driving cylinders are placed upright at the end of the boiler, and drive the wheels, which are situated at the tail of the engine, and which gear into the main driving wheels, which make about 14 revolutions, while the engines are working 280 revolutions per minute. The chief part of the weight of the machine is over these wheels, which are 6 ft. in diameter, with broad peripheries, so as to give a good hold upon the ground; they are also so arranged that they will adjust themselves to work at different speeds when rounding a corner. The total weight of the machine, including fuel and water, is seven tons, and its power that of six horses; there is also no difficulty in checking its progress when going down an incline.

The utility of this engine is not confined to traction purposes, as by means of clutches the engine can be disconnected from the driving gear, and can then be used for pumping, hoisting, or driving machinery; the whole machine rests on springs, and the condensed water from the cylinders, safety valves, &c., is used for heating the feed-water, so as to economise fuel as much as possible.

On reference to the engraving it will be seen that *A* shows position of boiler; *B*, the gearing; *C*, the driving-wheel; *D*, steering apparatus, and *E* the fuel box. As to the practical working of these engines, the results have proved most satisfactory. The amount of fuel consumed when in full work is 70 lbs, and of water 28 gallons, per hour. The speed of the machine with a load is equal to about three miles per hour, although alone it will run six easily; so, taking the other expenses, including 20 per cent. per annum for depreciation of the value of the machine, we have the following result, viz., that Taylor's engine will draw a weight of 16 tons a distance of 36 miles in the 12 hours at a cost of 2s. per ton; this is two-thirds of a penny per ton per mile. It would be waste of time to enlarge upon the advantages of this mode of traction over that by animal power. It is now an established fact, and the application of the system becomes a mere matter of economical mechanical arrangement and improvement from time to time.

TAYLOR AND GRIMSHAW'S PNEUMATIC APPARATUS.

The following has been submitted to us for publication:—"There may be seen at the Crystal Palace an instrument, recently patented by Messrs. Taylor and Grimshaw, of Southampton, which is calculated in a very high degree to add to our comfort and safety; it has a variety of action; perhaps its most prominent feature is its fire alarum apparatus. As such, it is capable of becoming a sideboard or bed-room ornament; it action is perfectly simple and invariable, either in a dwelling or factory, or in the hold of a ship. It may be set to any degree of temperature, when that is exceeded it indicates the fact; first, silently, then by its loud ringing alarm; or, if required, it discharges a powder cell



with the report of a pistol or nine-pounder, as may be required, either to alarm the inmates of a house or the neighbours of an uninhabited mill, church, or other edifice. A simple application of the hands to the sides of the machine at once sets the indicator in motion, and explains its action. A second form of its application is a ventilator. If tested in the same manner, it will open a ventilator, which will close on the removal of the hands. For common purposes, it may be set to any required temperature as may be needed for your chamber, conservatory, or barrack-room. When the required temperature be exceeded, the venti-

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lator opens, and so remains until the desired temperature be regained. As indicative of heat, it acts in the same manner, and can in the same way be tested for sea purposes: a long tube rising from the hold of a ship, or wherever required, having at its summit on deck a simple dial, which shows at all times the heat below, giving timely warning, and averting the sad calamity of a ship on fire at sea. It is also a heat regulator, working a damper by which air is admitted more freely, or excluded from the fire. It is susceptible of a variety of other applications. The above are all easily tested and understood. The principle upon which this variety of useful application is based is the enclosure of common air within an air-tight metal cylinder, having on its upper side a firmly-fixed diaphragm of india-rubber, upon which rests the spring which works the indicator. The enclosed air expands or contracts as the surrounding air becomes hotter or colder, acting in its expansion or compression on a spring which causes the indicator to show upon the dial the temperature obtained, and giving its loud warning when the dangerous degree has been attained. The apparatus in question has neither wheels nor arrangement capable of getting out of repair: no mercury or other fluid than air is used; and it would be rather difficult, without some trouble, to cause it to work inaccurately."

The above account proceeds from the inventors, and may be taken as their view of an apparatus which has been favourably spoken of in the city articles of most of our newspapers during the past week, and in other places. That our readers may be able to judge for themselves of the merits of Messrs. Taylor and Grimshaw's invention we have had the annexed engraving of it, as arranged for an alarum, prepared. *A* is the diaphragm, *B* a rod which rises and falls with it, and which has a threaded portion *C* working into a wheel on the axle of the pointer *D*. The pointer *D* indicates the temperature on the graduated arc *E*, and above this is a second arc which turns upon, and may be clamped to, the axle of the pointer. Above the second arc is a disc, bell, and hammer, so arranged and connected with a weight (not shown) that by suitably adjusting the second arc the hammer may be released and caused to beat upon the bell when any given temperature is attained.

ARTESIAN WELL AT WOLVERHAMPTON:

"ON AN ARTESIAN WELL IN THE NEW RED SANDSTONE AT THE WOLVERHAMPTON WATER-WORKS."

By J. F. BATEMAN, Esq*.

THE town of Wolverhampton has been up to a recent period supplied with water produced by two deep shafts—one sunk about 300 feet deep into the lower New Red or Permian measures, and the other to a somewhat similar depth in the New Red Sandstone proper. From both of these wells a large quantity of water was anticipated by the engineers who advised their construction, but their yield is under 200,000 gallons a day each, the water being pumped in one case from a depth of above 180 feet, and in the other 246 feet.

The quantity thus yielded being insufficient for the supply of the district, new works have been constructed which I have just completed for bringing water from the river Worth at Corford Bridge, about nine miles from Wolverhampton and three from Shiffnall, in the county of Salop.

The works are constructed for the supply of 2,000,000 gallons per day, and the water has to be forced to a height of 500 feet for the supply of the town.

The river Worth at the place at which the pumping works are constructed is not more than 40 or 50 feet above the Severn, which it joins at Bridgmouth, about eight or 10 miles distant. It may, therefore, be considered to be at the bottom of a basin, little elevated above the sea. From the character of the surrounding hills and the inclination of the beds of the New Red Sandstone, it appears to me very likely that, although the wells which had previously been sunk on the high plateau of Wolverhampton had proved comparative failures, a considerable quantity of water might be found in the sandstone at Corford Bridge, and that possibly some might rise to the surface and flow as an artesian well.

I therefore obtained the sanction of the directors of the company to sink a bore hole for the purpose of ascertaining the fact.

In some parts of the country, as in Cheshire and Lancashire on the shores of the Mersey, the New Red Sandstone is very clearly divided into four distinct portions, consisting of an upper hard mass about 300 or 400 feet thick, a soft mass about the same thickness, a second hard mass, and a lower soft mass, all of pretty much the same thickness. In the neighbourhood of Wolverhampton and Shiffnall, these distinctions are not so clearly exhibited, but I had reason to believe, from the portion of the works, that a bore hole of about 200 feet in depth would pierce the hard rock on which they were situated and reach the soft rock beneath.

The bore hole was commenced twelve inches in diameter, and continued at that size for seventy feet in depth, when it was diminished to seven inches, and continued for 190 feet, one being a total depth from the surface of 260 feet.

The first water was met with at a depth of 25 feet 4 inches, and from that time it rose to the surface and flowed over an artesian spring, increasing in quantity as the depth increased, till the boring was discontinued, at which time it amounted to about 210,000 gallons per day.

The following table will show the manner in which the water increased:—

Depth below surface. Ft.	in.		Yield in 24 hours. Galls.	Depth below surface. Ft.	in.		Yield in 24 hours. Galls.
25	4	...	2,880	119	0	...	37,023
29	4	...	3,553	123	6	...	43,200
37	6	...	3,602	142	4	...	61,899
45	0	...	5,400	159	2	...	74,055
63	3	...	9,257	169	6	...	86,400
78	6	...	18,514	178	11	...	129,600
86	9	...	21,600	185	6	...	130,896
95	0	...	23,563	211	1	...	163,200
101	0	...	25,920	221	7	...	183,600
111	2	...	32,400	269	0	...	200,830

Throughout the whole depth of boring the rock varied little in character. It was nearly all hard rock. Sometimes very hard, with occasional beds of softer stone. For the last forty feet or so, the soft beds were thicker, but otherwise there was little change from top to bottom.

The greatest increase of water took place at 214 feet and 227 in depth, at each of which depths there was an increase of 20,000 gallons per day.

The soft rock I anticipated was not met with at the depth I expected, but sufficient was done to prove the abundance of water. A large bore hole, which would permit the descent of a larger column of water, would materially increase the produce as an artesian well, while a shaft sunk thirty feet or forty feet deep, and exhausted to that depth by pumping, would yield a very considerable quantity. As the whole rock is charged with water to the level of the river which forms its natural outlet, and as the boring shows that the lower beds receive their supplies from distant sources, the supply to be obtained may reasonably be expected to be inexhaustible within the limits of that which is due to the percolation of the rain upon the collecting area.

* British Association, 1859.

On Saturday the great bell of Westminster sounded for the last time, and while in the very act of striking Big Ben became dumb for ever. The bell is even more hopelessly cracked than its ill-fated predecessor. Such a weary deal has to be done before Ben's mutilated fragments find their way to the melting pot, and still more before the renovated mass is again restored to its lofty dwelling, that, even taking a sanguine view of things, we think, with the *Times*, that at the least a clear twelvemonth must elapse before the voice of the great bell can again be heard booming over the great province of houses in which it is to regulate the laws of time. The cause of its destruction is explained by Mr. Loseby on another page.

ON A SAFETY CAGE FOR MINERS.

By ROBERT AYTOUN.*

THE object of the present invention is to save the lives of miners who may happen to be in the cage at a time when the rope to which it is attached gives way.

It fortunately happens that almost every shaft is provided with a pair of strong wooden rods, called guide-rods, which extend from top to bottom. These are placed on opposite sides of the shaft with the cage between them. The latter is furnished with iron shoes or slides at top and bottom, which loosely embrace the guide-rods and constrain it to keep one path in ascending and descending.

To cause the cage, on the failure of the winding tackle, to cling to these guide-rods is the object sought in all safety cages.

My plan for effecting this is a mere adaptation of an instrument well known to miners—the key or wrench used for raising and lowering the boring-rods. This little instrument has never been known to lose its hold. It supports 100 fathoms of rods with the same tenacity that it does ten. Indeed, the greater the weight it is required to hold, the firmer is the gripe. It therefore is admirably calculated to support the cage, which, in addition to its own weight and load, may have to bear the weight of some hundred fathoms of rope precipitated on it from above.

To adapt this instrument to the cage, a slight modification of the upper shoes and slides is all that is necessary. These shoes or slides are, as usual, two in number, and placed on the opposite sides of the cage and in opposite directions. Each of them has a single bolt or stud, by which it is attached to the cage, and around which it turns; a long arm, to the extremity of which the winding chain is attached; a stop, which prevents the arm from being pulled above the horizontal line; and a spring, which lowers it when the winding chain is slack.

From this description it is easily seen that in the event of the rope or gearing giving way, the springs so tilt the shoes or slides that they immediately seize hold of the guide-rods, in the same manner as the boring key in the hands of a miner lays hold of the boring rods, and with the same tenacity of gripe; and although the rope should come down on the top of the cage, the only effect would be to cause the shoes to dig deeper into the guide-rods, and thus to make the hold more secure.

STRAIGHTENING A CHIMNEY STALK.

THE operations for restoring the colossal chimney at Port Dundas to a perpendicular and safe position are now successfully completed. This was accomplished by sawing several of the mortar beds between the courses on the side from which the chimney leaned, thereby allowing it to come back by its own weight, without the application of any external force. Only one draft was cut at a time, to guard against any shock which might have endangered the stability of the building, and by keeping the saws wet a bed of mortar was prepared for the superincumbent weight to settle down upon. 12 cuts were made in this manner, on different parts of the structure, which generally set before the saws had passed through half of the circumference, particularly in those made nearest the ground, where the weight was greatest. We have to congratulate the proprietor and Mr. Duncan Macfarlane, architect, by whose advice this method was adopted, on the success of their undertaking. The principal dimensions of the chimney are:—Total height, 468 feet; from surface to top of cope, 454 feet; outside diameter at foundation, 50 feet; at surface, 34 feet; at cope, 14 feet. According to calculations made by Professor Rankine, the building, independent of the adhesion of mortar, is capable of sustaining with safety a lateral pressure of 66 lbs. per superficial foot at its weakest point, being 11 lbs. more than the force of the greatest storm registered in this country.—*North British Daily Mail.*

* British Association, 1859.

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ON THE NOMENCLATURE OF METRICAL MEASURES OF LENGTH.

By G. Johnstone Stoney, M.A., M.R.S.A.*

In this paper many circumstances were pointed out which render the French names of decimetre, centimetre, and millimetre, unsuited to this country. They are foreign to the genius of our language, which delights in short pithy words; the information they convey is useless, as the fact that each measure is one-tenth of that above it is one of that class which it is impossible to forget, and they fail in several common requisites of a good nomenclature.

Names of measures for ordinary use should, if possible, be monosyllables; for the convenience of reference they should begin with different initial letters; they should so wholly differ in sound that even when imperfectly pronounced they could not be mistaken for one another; and they should convey some information which would facilitate the use of the measures by those who are unfamiliar with them.

To combine these advantages it was suggested that *hand* or handbreadth should be used as the English equivalent for decimetre; *nail* or nail-breadth for centimetre; and *line* for millimetre. The author stated that he had had abundant experience of the assistance afforded to beginners by these names, from their promptly suggesting, without any mental effort, the *absolute length* of each measure.

Attention was also directed to the importance of giving a distinct name to the tenth part of the line or millimetre, in order to discourage the use of binary subdivisions. *Mite* was suggested as a suitable name.

The paper closed by urging that the use of foot-rules graduated along one side to metrical measures should in every possible way be encouraged.

MR. LOSEBY ON BIG BEN.

To the Editors of the "Mechanics' Magazine."

October 1.

Gentlemen,—The great bell of the clock-tower has again been broken. This has resulted from the use of a much larger hammer, for the weight of the bell, than the usual proportion, and the employment of so great a quantity of tin in the composition as to render it unusually brittle.

For this disaster, as well as for the former, Mr. Denison is entirely responsible.

After the confirmation of the views concerning the enormously disproportionate force of the first hammer, which I published in the Mechanics' Magazine months before the first bell was broken, others have shared the opinion that the second bell would meet the same fate as the first. I may particularly mention Mr. Quarm as having expressed his conviction to that effect, and Mr. James as having proved the extreme brittleness of the metal by breaking three small bells, made from the same composition, with very light blows, in Mr. Denison's presence, at Messrs. Mears's foundry.

Surely Mr. Denison's career as bell-founder and clock-maker, under the sanction of Government, will now come to an end; for it has resulted in more failures, and brought greater discredit on the arts of bell-founding and clock-making than we otherwise find recorded in this country during the last century. Yours, &c.,

E. T. Loseby.

October 4.

Gentlemen,—Since the above letter was written, an account has been published in which the cause of the fracture is ascribed to the bell having been tightly screwed up to the frame, without the possibility of motion when it was struck. This is erroneous, as I noticed the bell whilst sounding the hour on Wednesday last, and observed it to recede at least three-quarters of an inch from one of the blows; and it must, moreover, be remembered that where clock hammers are used on *swinging* bells they are placed at a right angle to the plane in which the bell swings, and that they cannot therefore recede from the blow beyond the small quantity which the beam and other parts bend; and which altogether does not generally amount to one quarter the space through which the present bell receded. At the same time there is no doubt but that the larger the bell, the greater distance it should be allowed to play, not only to guard against fracture, but to permit the hammer to follow it up and remain in contact long enough to overcome the inertia of the mass, and set the entire bell in sonorous vibration.

In order to carry out these views Mr. Quarm proposed that the bell should be suspended from a ball and socket joint to allow it to yield and gradually absorb the force of the blow; but the plan was not adopted. My own plan for the same purpose is as follows:—The bell to be suspended so that it can oscillate freely in the plane of the blow, but not in any other, and it will then become a pendulum swinging in tolerably uniform intervals; then let the time of its oscillation be ascertained, and the interval between the blows of the hammer be so regulated that the bell should be making one of its return vibrations as the hammer descends to meet it. Each blow would then be made to neutralise the motion caused by the last one; and all accumulating or uncertain motion be prevented, and the advantages would be secured of the bell hanging perfectly free to accommodate itself to the force of the blow, without the recoil spring having to keep the hammer at a great distance from the bell. The strain on the mountings and frame would also be considerably reduced. Yours, &c.,

E. T. Loseby.

SPILL'S MILL BANDS.

These bands are now being applied to the Government works at the Royal Arsenal, Woolwich, and at the Ordnance Small Arms Department at Enfield, to drive machinery at both these important official establishments. Besides the tests to which they have been, and are continued to be submitted at the Government contract works on Stepney Green, several of our most eminent engineers have put the material privately to various extreme tests, and many very interesting conclusions have resulted. Not the least of these is its perfect adaptability to paper mills, where from their thorough uniformity of thickness throughout, great smoothness of motion is secured, and the breakage of the paper or disintegration of the flocking of the fibre is entirely got rid of. This will be shown to those acquainted with the peculiar necessities of the case and the singular evenness of the patent band. The same reason likewise gives it singular advantages in flour mills where "lifts" are employed. Another peculiarity in the economy of these bands is worthy of notice; although one surface may wear in process of time, the layer may be altogether removed, and thus the band is only decreased in thickness, but not in comparative utility, as with its regular diminution of thickness it merely sinks to a lower application of power; for instance, say a six-ply band has been in use for months upon a 30-horse power engine, the necessity of the removal of one ply may or may not make it necessary to place it upon a 20-horse power.

ASSOCIATION OF FOREMEN ENGINEERS.

At the ordinary monthly meeting of the Association of Foremen Engineers, held at 35 St. Swithin's-lane, City, on Saturday last, Mr. Hayes continued his series of papers illustrative of the manufacture of the rifle. The portion of the weapon which was more particularly alluded to on this occasion was the bayonet—the strength, lightness, and beauty of which, as a mechanical piece of work, are remarkable. The various processes connected with the completion of the warlike fitment were described carefully by the reader of the paper, but his explanations were rendered much more plain from the fact that a perfect and exquisitely finished Enfield rifle lay on the table for the inspection of the members. Space will not admit of our going, at present, fully into detail with regard to the manipulations of the rifle-bayonet, but the number of these is considerable—more, indeed, by far than a casual glance at the instrument of death would lead one to suppose. Suffice it to say that Mr. Hayes' very lucid account of it met with the cordial approval of his brother foremen, who, after the discussion, and at the instance of Mr. Briggs, accorded him a vote of thanks for his pains.

Mr. J. Newton, who filled the chair on this occasion, took the opportunity of saying towards the close of the proceedings that he had a very gratifying duty to perform, and it was that of proposing also a vote of thanks. The beautifully-made implement of war which lay on their table had been in the kindest manner possible sent for their inspection by Col. W. M. Dixon, R.A., Superintendent of the small-arms factory at Enfield Lock, and who had on several previous occasions shown the utmost anxiety to forward the interests of the Association of Foremen Engineers, and it would ill become them not to acknowledge his disinterested friendship. Mr. Newton then formally proposed that "the thanks of the meeting be given to Colonel Dixon for having forwarded the rifle-musket for their instruction that evening, and for his general goodwill towards the Society." Mr. Keyte seconded this "with great pleasure," and it being carried by acclamation, Mr. Hayes was commissioned by the chairman to convey an intimation of the vote to the Colonel.

Shortly after this the meeting came to an end.

Our Weekly Gossip.

We find that the remarks attributed to Mr. Neilson in our last week's article upon the hot-blast iron question were made by Mr. Marten, of Wolverhampton, at a meeting at which Mr. Neilson spoke. Mr. Neilson's observations preceded those of Mr. Marten, and the transition from the speech of one to that of the other, being marked only by the use of capital letters in the name of the latter gentleman, was not observed by us.

Under the provisions of the Mercantile Marine Acts the Great Eastern would not be permitted to carry passengers on her trial trip, and the directors have just discovered that they would be liable to heavy penalties if they did so before receiving the certificate of the Marine Department of the Board of Trade. We are informed on good authority that Mr. Scott Russell will take charge of the paddle-engines and boilers on the next occasion, and that Messrs. Boulton and Watt will in like manner hold themselves responsible for the screw engines and boilers, both finding their own officers and men. We hope to be on our way to Weymouth, for the purpose of being present at the trial trip, before this Number reaches our readers.

A course of six lectures on Social Science, embracing all the relations between labour and capital, is about to be delivered by Mr. Wm. Ellis, under the authority of the Committee of Council on Education, at the South Kensington Museum. These lectures are particularly addressed to school teachers, but the general public will be admitted as far as there may be room in the theatre. The first will be given on Tuesday, 11th Oct., and they will be continued on each succeeding Tuesday.

The *Illustrated News of the World*, of Saturday last, has the following:—"In the *Times*' graphic description of the opening of the Swansea docks the other day, there was a slight but interesting notice of the delicate potency of Sir William Armstrong's hydraulic apparatus, evidenced in the case with which the presiding young lady of the occasion made huge gates and other heavy masses move by a trifling pressure of her hand. Sir William Armstrong's fame, with the general public, rests upon his celebrated gun; but his most intimate friends and admirers always maintain that eventually his application of vastly improved hydraulic power will be of paramount value and importance, and will yield results second only in importance to those of the steam-engine Sir William's gun experiments date only from 1854, but his hydraulic inventions are much older. He was born in 1810, and at the age of twenty-eight, when still a lawyer, he wrote to the Mechanics' Magazine on the improved application of water-power, then (and, perhaps, now) his favourite subject. Some of our readers may remember the steam-electrical machine which he exhibited at the Polytechnic Institution, and which attracted such very general attention. If all we hear be true, perhaps some Great Eastern of the future may be worked by an improved hydraulic engine of Sir William's. What a triumph of mechanical skill; no coals, no over-heating, little or no dread of fire or of explosion." We need hardly say we do not share in the anticipations of the last two sentences.

* Abstract of British Association Paper, 1859.

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The following report on the state of the Thames is from Mr. Bazalgette, the engineer of the Board of Works:—"I beg to report that in consequence of the decrease in the temperature the liming operations were maintained during the daytime only from the 12th of August to the 3rd instant, at which latter date, upon the advice of Dr. Miller, the operations were discontinued. The total quantity of disinfectant agents used during the past season has been about 4,231 tons of chalk lime, 478 tons of chloride of lime, and 56 tons of carbonic acid, at a cost of £17,733.

The following information respecting the Royal Gardens at Kew, furnished by W. J. Hooker, Esq., the Director of them, will be of value to many readers:—The Botanic Garden constitutes one portion of the Royal grounds of Kew. It comprises 75 acres, includes all the plant-houses, and is separated by a light wire fence from the pleasure-grounds. It is accessible to the public every day (Good Friday alone excepted), from 1 o'clock (2 o'clock on Sundays) till sunset, throughout the year. The pleasure-ground is an adjacent part of the demesne—a richly-wooded park, bordered on one side by the Thames, consisting of nearly 250 acres, and now, by recent planting, constituting a noble arboretum of all trees and shrubs that will bear our favoured climate, and intersected with extensive and well-kept walks. A lake of five acres, with islands, is forming, and a new conservatory, or winter garden, of unprecedented size, for tender trees and shrubs (rhododendrons, camellias, &c.), is sanctioned and provided for by the Crown. This building will be erected by Mr. Decimus Burton, the architect of the palm-house, and is to be commenced forthwith. This fine piece of ground, possessing no particular attraction in winter, nor much shelter in bad weather, has not hitherto warranted the cost of gate-keepers, &c., necessary for the admission of visitors at that season. The expressed wish of the public has, however, been considered by the First Commissioner of Works, and Mr. Hooker has been instructed by that gentleman to keep open the pleasure grounds during the present month of October. There are three entrances to the pleasure grounds from the public road; first, by the Brentford-gate; second and third, by the Lion and Unicorn gates on the Richmond-road. The entrance to the Botanic Garden is open daily, and during the period when the public have access to the pleasure-grounds there are communications by four gates between these grounds and the Botanic Garden.

The *Times'* Paris Correspondent still contends that the French Government is most active in respect to its fleets and naval defences. He tells us that in the *Moniteur de la Flotte*, the semi-official organ of the naval interests of France, the following passages appear:—"There has just been finished at L'Orient the Couronne, ship-of-the-line of the second class. This vessel is one of 10 now in construction, and which are to be finished within a year from this time." The *Armoricain* of Brest says:—"Our port has just put upon the stocks the ship-of-the-line Magenta, the construction of which has been ordered by the Emperor, and the plans of which have been made by M. Dupuy de Lôme, Director of Matériel at the Ministry of Marine, after the Emperor's own ideas. This vessel will be *blindé* (steel-plated). Its length will be, it is said, 100 metres (328 English feet), including the large iron spur which it will bear in its front. It will be a pattern vessel of a new model." Letters from the provinces confirm, he says, what he recently wrote respecting the general armament of the French ports and coasts. "I am assured that on the Provençal coast the Government has purchased pieces of land at very high prices, for the purpose of erecting fortifications upon them." The *Echo Agricole* has the following paragraph:—"The War Department has just sent to Cherbourg, St. Malo, and other points of our coast the plates which are to be used in the establishment of revolving batteries. These plates are broader and stronger than those employed on railways to change the direction of locomotives and waggons; like these last they are composed of various pieces, which fit into each other when mounted on the wooden framework which puts them in motion. Thus a cannon placed on these new platforms may be turned in an instant in any direction, at the will of the gunner." A letter from Boulogne says that a floating battery is about to be constructed there, with a double tier of guns. It is to be iron-plated, without masts or sails, navigated by steam, and armed with rifled guns.

The prospectus has been issued of the East India Steam Navigation Company, with a capital of £120,000, in £5 shares. The object is to send out steamers to navigate the inland rivers of India—the principal existing company engaged in that trade having for years past realized great profits.

NOTICES.

We have to acknowledge the receipt of numerous letters, papers, periodicals, and other communications which we cannot here refer to in detail. Many of these will appear at an early opportunity—some of them next week—but are unavoidably deferred for the present.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance.* Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

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Special Arrangements for larger or Serial Advertisements

To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

CORRESPONDENT'S QUERY.

GENTLEMEN,—Will some of your readers favour me with the power of metals to resist a twisting strain, when in the form of a solid cylinder, and when in the form of a hollow cylinder—the quantity of metal in each being equal? A MECHANIC.

October 4th, 1859.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 630.
BOILERS AND THEIR FURNACES, &c., 576, 588.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 591, 592, 596.
SHIPS AND BOATS, including their fittings, 553, 559, 578, 583, 615, 616, 623, 632.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 581, 584, 610, 626, 628.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 565, 605.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 554, 558, 560, 567, 574, 575, 579, 582, 586, 593, 597, 598, 600, 627.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 563.
LIGHTING, HEATING, AND VENTILATING, 569, 577, 580, 606, 609.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 555, 556, 562, 614, 618.
METALS, including apparatus for their manufacture, 594, 619.
CHEMISTRY AND PHOTOGRAPHY, 589.
ELECTRICAL APPARATUS, 607.
WARFARE, 564, 566, 573, 611, 620, 624, 625.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 552, 554, 557, 559, 561, 568, 570, 571, 572, 585, 587, 590, 595, 599, 601, 602, 603, 608, 609, 612, 613, 617, 621, 622, 629, 631.

552. F. J. JONES. "An improvement in buckles and clasps." Dated March 2, 1859.

This consists in the use of a compass as an ornament in buckles and clasps. *Patent abandoned.*

553. J. W. HARKER and J. K. FIELD. "Improvements in coating the bottoms of iron and other ships and vessels." Dated March 2, 1859.

This consists, 1, in applying a comparatively insoluble soap, prepared by boiling an oxide of lead with fat or oil, to the coating of the bottoms of iron and other ships, such application being made hot. 2. In applying the substances produced by the action of deutoxide of nitrogen in fatty and oily matters to the coating of the bottoms of ships, such application being made hot. *Patent completed.*

554. E. ROCHE. "Improvements in the manufacture of paper suitable for forming cigarettes and for other purposes, and also improvements in the manufacture of cigars." Dated March 2, 1859.

The patentee claims the application of the ribs of the leaves, and the leaves and the juice of tobacco, to the manufacture of paper, suitable for forming cigarettes, &c., and also moulding the paste obtained from these matters into cigars. *Patent completed.*

555. C. HILL. "An improved construction of stay fastening." Dated March 2, 1859.

This relates to a construction of stay fastening, which permits of the stay being slackened or tightened as required without interfering with the lacing. This result is attained by forming the steel busk with slots for the reception of a hook. *Patent abandoned.*

556. W. E. NEWTON. "Improvements in the construction of barometers, or instruments to indicate pressure." (A communication.) Dated March 2, 1859.

The object here is to produce a portable barometer in a cheap form. One of the essential features of the instrument is a box made of metal, glass, caoutchouc, or other material which is sufficiently elastic by its nature, or by the form of the ox, to admit of the atmospheric pressure compressing or acting upon it naturally. *Patent completed.*

557. J. H. JOHNSON. "Improvements in the construction of grease boxes, and bearings generally. (A communication.) Dated March 2, 1859.

The objects here are efficiently lubricating the working parts of the axle, &c., preventing the escape of lubricating material, and avoiding the entrance of dust or other foreign matters into the bearings. We cannot give space to the details of the invention. *Patent completed.*

558. J. KERSHAW. "Improvements in means or apparatus employed in weaving." Dated March 2, 1859.

This consists, 1, in means for regulating the delivery of the warp as drawn from the warp beam or roller. 2. In means for effecting a uniform winding on of the work on to the work-roller beam. *Patent completed.*

559. J. NEWCOMB and J. G. LOVELL. "Improvements in obtaining and applying motive power, especially adapted, amongst other purposes, to the propelling of ships and vessels." Dated March 2, 1859.

This invention is not clearly described apart from the drawings. *Patent completed.*

560. H. BROWN. "Improvements in machinery for cutting and finishing the surfaces of woollen and other fabrics." Dated March 2, 1859.

Here the lengths of cloth, &c., are passed over a metallic bar, the upper surface of which is indented, turretted, or castellated in divisions of the required width, the end which first passes over being secured to a revolving roller. On the fabric to be finished is placed immediately above the castellated bar, a circular revolving knife which presses the cloth between it and the bar before mentioned, the consequence being that the only parts of the fabric upon which the knife operates are those which touch the top surface of the turrets, the other part falling into the spaces between each turret; the fabric upon leaving the machine will have the appearance of having furrows cut therein. *Patent completed.*

561. W. BROWN. "Improvements the manufacture of pipe mounts or stems, cigar tubes, and similar articles." Dated March 2, 1859.

The object here is to make the stems of pipes, cigar tubes, &c., of English pipe clay, in lieu of the bone, horn, &c., and ornamenting them either in moulds or by hand, to represent the pipe stems, mounts, or cigar tubes now in use. *Patent abandoned.*

562. H. KOHN. "Improvements in articles of wearing apparel called coats." Dated March 3, 1859.

This consists of a coat so cut and arranged as to be worn either as a frock or dress coat. *Patent abandoned.*

563. J. HARRISON. "An improvement or improvements in the construction of rotating window-sashes." Dated March 3, 1859.

This consists in constructing window sashes to turn on centres, so that the outside of the sash may be turned inside, and the inside turned outside. *Patent abandoned.*

564. T. WILSON. "An improvement or improvements in breech-loading fire-arms." Dated March 3, 1859.

The inventor forms at the rear end of the barrel a breech open at top, and of sufficient size to permit of the ready introduction of the charge. On the side of the opening in the breech a cover is hinged, which when shut down closes the opening in the breech. To the cover a bolt or breech plug is attached, the said bolt when the cover is shut down entering and nearly filling in the breech. The said bolt is so attached to the cover that it is capable of a sliding motion in a line coincident with, or parallel to the axis of the fire-arm. A screw bolt passes through the extreme end of the breech, and may be turned by a handle or lever jointed to its end. The charge is introduced at the open breech and inserted in the barrel. The cover with its sliding bolt is shut down upon the opening, and the screw is turned so as to press upon the said

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bolt and cause it to close the end of the barrel, when the arm may be discharged. *Patent abandoned.*

565. A. W. HALE. "A new and improved machine for cutting or mincing meat, vegetables, &c." Dated March 3, 1859.

This consists in the use and arrangement of one or more grooved cylinders or rollers revolving in a grooved or ribbed case, and acting against a stationary knife, such grooved cylinders having also tapering or diminishing grooves, so as to prevent the passing of the article until cut finely enough, and also to keep the article continually against the cutting surfaces or knives. *Patent abandoned.*

566. J. D. DOUGALL. "Improvements in fire-arms." Dated March 3, 1859.

This chiefly consists in forming the breech with a solid conical igniting conductor, to ensure the ignition of the charge at the front of the cartridge instead of the back. *Patent completed.*

567. W. JACKSON. "Improvements in shuttles for looms." Dated March 3, 1859.

This consists in a method of constructing the shuttle so as to prevent the cop from flying off; for this purpose the inventor constructs the tongue of tempered steel, and adapts it so as to be fast at both ends upon the shuttle peg. *Patent abandoned.*

568. W. SCORE. "Improvements in the manufacture of soap." Dated March 3, 1859.

This consists in rendering the fatty and oily matters obtained from wash waters suitable for use in the manufacture of soap by blowing free steam into them to melt them, and washing them repeatedly with weak alkaline solutions or spent leys, the process being conducted in a pan heated by steam. *Patent completed.*

569. H. LEONARD. "An improvement in the manufacture of paraffine candles." Dated March 3, 1859.

Here the inventor employs a candle mould in which the body and tip matrices are separate from each other, and the tip matrice is applied to the tubular body matrice so as to be capable of being moved therein so as to enable a person by such movement to expel the candle from the mould. *Patent completed.*

570. W. TUCKER. "An improvement in bit stocks or auger handles." Dated March 3, 1859.

This invention is not described apart from the drawings. *Patent completed.*

571. T. COOK. "An apparatus for raising and lowering coffins and bodies, either for burial or disinterment." Dated March 3, 1859.

This consists of a framework with supports which bridge across the grave, together with a winch and straps suitably arranged for lowering and raising the coffins. *Patent abandoned.*

572. W. MITCALFE. "Improvements in discharging cargoes, and in raising and lowering bodies." Dated March 3, 1859.

This consists in taking advantage of the flow of the current (by means of a water-wheel) to accumulate power, by which baskets of coal, &c., may be readily hoisted out of a ship's hold. *Patent abandoned.*

573. C. F. DENNET. "Improvements in bayonets." Dated March 4, 1859.

This consists in forming bayonets of a lozenge, rhomboidal, elliptic, or other suitable section. The sides of such bayonets may be grooved out so as to reduce the thickness of material in the section, two sharp edges being left throughout the length of the bayonet, the section gradually decreasing from the shoulder to a sharp point. *Patent completed.*

574. M. RIDER. "Improvements in, or applicable to, machines for preparing, spinning, and doubling cotton, and other fibrous materials." Dated March 4, 1859.

This consists in certain combinations of machinery particularly applicable to the machines for spinning called 'throstles,' the object being to facilitate the operations of doffing the full bobbins, and replacing empty bobbins on the spindles. *Patent abandoned.*

575. J. COWBAN and E. ANDREWS. "Improvements in machinery or apparatus for spinning fibrous materials." Dated March 4, 1859.

This relates particularly to that description of mules in which the mangle motion is used commonly known as "Smith's" plan. The patentees employ a shaft through the headstock for connecting the spindle gearing in each carriage, which shaft is driven by one band for putting the twist in the yarn equally in each carriage. They also use a quadrant similar to that employed in "Sharp and Robert's" mules for procuring a positive winding-on motion; thus instead of two run bands they employ but one, which in connection with the quadrant enables them to have both a positive twisting and winding-on motion. *Patent completed.*

576. R. A. BROOMAN. "An improvement in boiler stays." (A communication.) Dated March 4, 1859.

This consists in a method of forming boiler stays of cylinders or tubes passed through enlarged rivet or bolt holes, and afterwards expanded at the ends adjacent to such holes. *Patent completed.*

577. C. R. MEAD. "Improvements in water gas meters." Dated March 4, 1859.

This invention is not described apart from the drawings. *Patent completed.*

578. W. and J. BAILES. "An improved ship's berth for the prevention of sea-sickness, composed of wood and metal." Dated March 5, 1859.

This invention is not described apart from the drawings. *Patent completed.*

579. J. M. DUNLOP. "Improvements in machinery or apparatus for cleaning fibrous materials." Dated March 5, 1859.

The object here is to make the "Mc Arthy Gin" suitable for working by manual labour. The patentee applies a first motion shaft carried in bearings fixed to the gin sides on each end of which he fixes a handle; on one end of the said shaft, and immediately behind the handle, he fixes a spur wheel which drives or gears into a spur pinion fixed in the roller covered with leather usually used in the above-named gins. These wheels are of the necessary respective diameters to obtain sufficient speed for the efficient working of the gin when driven by hand. *Patent completed.*

580. J. LEIGH. "Improvements in the purification of coal gas." Dated March 5, 1859.

This consists in the application of causticized gas water or ammonia water to the purification of coal gas or camel gas. The patentee effects this by passing the gas through the gas water in suitable vessels, to remove from the gas not only the salts of ammonia existing therein, but also the carbonic acid, sulphuretted hydrogen, sulphocyanic acid, &c., which may exist also in the impure gas. *Patent completed.*

581. J. FRASER. "Improvements in ploughs." Dated March 5, 1859.

This consists in manufacturing the mould boards of ploughs so as to have one portion harder than the rest. The part exposed to severe wear is chilled in the casting, whilst the other part is left soft. *Patent completed.*

582. F. W. PARKER. "Improvements in sewing machines." Dated March 5, 1859.

Here the patentee employs a needle with an eye near the point, and attached to a piece of metal sliding up and down in a guide, and driven by a crank. The needle moves up and down through the work which is laid upon a table with a hole for the passage of the needle. Below the table is a hook or looper capable of turning on a horizontal axis or spindle, which has also an end motion. When the needle has passed through the work, and commences to rise again, the thread bends or bows out at its side, and the hook is then passed through the loop thus formed. The spindle of the hook or looper receives an end motion as soon as the looper has passed the side of the needle, and the looper is caused to hold or present the loop in a line with the seam so that the needle is sure to pass through it in its next descent. When the needle has thus entered the loop, the looper slides endways, and partially turns on its own axis so as to bring it back to its original position. The motions are then repeated, and the looper now enters the new loop and holds it as before. *Patent completed.*

583. E. VIGERS. "Improvements in the construction of ships and other vessels." Dated March 5, 1859.

This consists in a novel combination of wood with iron in constructing the frames of ships, by which greater strength combined with other advantages is secured. *Patent abandoned.*

584. W. P. SAVAGE. "An improved machine for excavating, raising, and depositing soil. Dated March 5, 1859.

Here the earth is raised by two sets of iron cups or buckets revolving upon axes. The two sets of cups descend into the land at different depths; one set is arranged to cut into and remove the upper surface, and the other set to cut into and raise the earth from below. *Patent completed.*

585. F. VERDEIL and E. MICHEL. "Improvements in treating madder." Dated March 5, 1859.

This consists in treating madder with an alkaline liquid, then in exposing it when in contact with the alkaline liquid to the action of air to oxidise it, and in afterwards boiling the madder thus prepared in acid. *Patent completed.*

586. G. LEACH. "Improved machinery for reeling and leashing yarn or thread." Dated March 5, 1859.

This relates to machinery whereby yarn or thread may be reeled into hanks, and in doing which the threads are made to cross each other so as to form a crossing at or near the centre or other convenient part of the hank. *Patent completed.*

587. F. MORTON. "An improvement in the construction of strained fences." Dated March 5, 1859.

The inventor proposes to draw the strands, cords, wires, wire rods, hoops or bands of strained fences up to tension by passing them through rollers, barrels, or pulleys provided with any convenient contrivance whereby rotary motion may be communicated to them. *Patent abandoned.*

588. R. LEAKE and M. SYKES. "Improvements in furnaces for consuming smoke and generating heat, parts of which improvements are applicable to furnaces generally." Dated March 5, 1859.

This relates to a former patent dated 1st May 1857, and is based on the fact that 4-5ths (by weight) of water is oxygen, and, bulk for bulk, water is 825 times heavier than common air, so that when 4-5ths are taken from the gross weight of water it gives 660 times more oxygen in one inch of water than is contained in atmospheric air of the same bulk, and when water (in proper quantity) is introduced to the fires in furnaces of steam boilers through the spaces between the fire bars, instead of having a cooling affect it will give off a large quantity of gases, and produce a more intense heat than can be produced in any other way except where means similar to those employed in blast furnaces are adopted. *Patent completed.*

589. H. W. PATRICK. "An improvement or improvements in an apparatus for chemical and dental laboratories, or other manufacturing or experimental uses,, which he proposes calling a 'paragon laboratory forge.'" Dated March 7, 1859.

This consists in the construction and arrangement in an apparatus of a smelting furnace, an annealing furnace or oven, a digester with a dry hot bath for dry heats, a sand bath, and a steam bath, a brazing lamp, to be used separately or detached, and portable; and the whole so constructed as to be heated by coal-gas or any other gases or fuel, and by means of a portable funnel to connect the same with the flue of a chimney; or it can be used without such connexion. *Patent abandoned.*

590. D. PROUDFOOT. "Improvements in Turkey-red dycing." Dated March 7, 1859.

This relates to the application and use of the fruit of the velam tree or Turkish oak in the preparing and dycing of cotton cloth and yarns according to the Turkey-red process." *Patent abandoned.*

591. A. CABANY. "A new system of quoins (wedges) for railways." Dated March 7, 1859.

The inventor substitutes for the ordinary quoin or wedge used to maintain railway chairs and rails in position, one which he terms a double or twin wedge, so arranged that the parts shall, as it were, dovetail, the traction and lateral jerks of the rolling stock at speed serving more securely to fix the combination of rail-wedge and chair together. *Patent abandoned.*

592. W. PALMER. "An improved railway carriage break, and coupling apparatus connected therewith." Dated March 7, 1859.

Here each carriage carries its own apparatus and each wheel is locked by means of a friction wheel or pulley, so that a long train may be stopped in as short a time as a short train. *Patent completed.*

593. F. AYCKBOURN. "Laminating india-rubber cloths with paper sheets." Dated March 7, 1859.

This consists in coating the surfaces of suitable fbrics, and also the surfaces of sheets of paper, with india-rubber solution, bringing the solutioned surfaces together, and passing the whole between rollers. *Patent abandoned.*

594. W. GOSSAGE. "Improvements in the treatment of certain ores of copper for the extraction of metals therefrom." Dated March 7, 1859.

The patentee claims, 1, a combination of processes by which he extracts copper and oxide of iron (suitable for the production of malleable iron) from burned sulphurous coppery pyrites, by the use of per-salt of iron in solution, which per-salt of iron is by such extraction of copper reduced to the state of proto-salt of iron, and which combination of processes or operations includes the conversion of proto-salt of iron so produced into per-salt of iron, by exposing it when in a dry state to the action of heat and atmospheric air; also the application of such combination of processes and use of per-salt of iron together with common salt to the extraction of silver from such burned sulphurous coppery pyrites as contain silver. 2. The use of per-salt of iron contained in the "mure waters" used for extracting copper from the burned sulphurous coppery pyrites. 3. The use of metallic iron, and of proto-sulphuret of iron, both obtained from the burned sulphurous coppery pyrites for the precipitation of copper from solutions containing such metal. *Patent completed.*

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595. J. ASPINALL. "Improvements in evaporating in vacuo." Dated March 7, 1859.

The patentee claims evaporating in vacuo by means of steam or hot-air pipes whether free to rise and fall or stationary, maintained at the upper part of the vacuum pan, or at or about the surface of the liquor or substance to be evaporated. *Patent completed.*

596. P. E. AIMONT. "Improvements in the construction of waggons and other carriages for railways and ordinary roads, and of apparatuses connected therewith." Dated March 7, 1859.

The patentee claims, 1, a method of constructing waggons or carriages so that the wheels of the same shall be able to pass over any inequalities in the ground or round a curve without the body of the waggon, &c., departing from its vertical position. 2. The employment of rails with an upright tongue, and with a bottom having sloping sides, such rails being for waggons or other carriages to travel on, together with a method of attaching or linking the same together and fixing them to the ground. 3. The employment of an instrument provided with a plumb-weight to indicate the gauge of the way and the position of the rails. 4. The employment of a single line of rail in the middle of the rail or tramway as described. *Patent completed.*

597. J. ORR. "Improvements in weaving ornamental fabrics." Dated March 7, 1859.

This relates to a previous invention patented 23rd April, 1855. One part of the present invention consists in laying two shoots in place of one into each shed of the inner warp. Another part consists in producing fabrics of a similar description, but having one face only. *Patent abandoned.*

598. J. P. CLARKE. "Improvements in the manufacture of reels for the winding on cotton, linen, threads, silk, or other fibrous materials." Dated March 7, 1859.

This consists, 1, in inlaying discs or rings of bone, or ivory into the ends of reels. 2. In covering the ends of reels with a flanged disc of bone or ivory. 3. In forming holes in the cylinders of reels, which holes will show the extent of cotton, &c., the reel contains. 4. In making reels with two or more compartments, so as to wind cotton, &c., of different sizes or colours upon the same reel. *Patent completed.*

599. J. L. JULLION and G. PIRIE. "The manufacture of gelatine." Dated March 7, 1859.

This refers to the treatment of bones so as to obtain therefrom gelatine in a solid form, and consists in chemically separating the constituent parts thereof by causing them to be first cut or broken, and subsequently submitted in vacuo to the action of such acids as are suitable for forming soluble compounds of phosphate of lime. *Patent completed.*

600. J. KING and A. WILCOCK. "Improvements in certain parts of machines used in preparing, spinning, and doubling cotton and other fibrous materials" Dated March 8, 1859.

This consists in a mode of weighting and cleaning the drawing rollers. The top rollers are made so heavy that the hooks and weights may be dispensed with, and they are covered with flannel that the clears may be dispensed with. *Patent abandoned.*

601. A. BOOTH and A. BOOTH, jun. "Improvements in machinery or apparatus for making or manufacturing tags for laces." Dated March 8, 1859.

The patentee employs a series of circular shears or cutters placed the length of the tag apart, so that the metal may be cut into several strips at once, which are coiled upon spools as the cutting proceeds. Any suitable number of the said coils are then placed in a creel, and the strips brought to a machine adapted for cutting, punching, and finishing several tags at one revolution of the driving shaft. The said machine is furnished with a number of circular or other formed feeders for guiding and feeding the strips at a speed according to the desired size of the tag, the various sizes being regulated by change wheels. The measured lengths of the strip are cut, shaped, punched, and afterwards released by means of sliding movements effected by the compound action of cranks, excentrics, or cams, a vibrating or sliding gauge being employed to regulate the shape of the tag. *Patent completed.*

602. W. HALLIDAY. "Improvements in apparatus for preventing smoke and economising fuel." Dated March 8, 1859.

This consists in placing inside the boiler or other flues, a short distance behind the bridge, an apparatus composed of a suitable number of fire-clay tubes of from two to three feet in length, fitted into and between two end pieces of fire-clay. *Patent abandoned.*

603. G. TWIGG. "An improved fusee-igniter for the use of smokers." Dated March 8, 1859.

This consists in the construction of a small apparatus for the pocket, which apparatus shall form a safe receptacle for fusees, and also a self-acting igniter, so that a person may be enabled to carry with him a large number of fusees in small compass, and readily obtain a light without breaking the fusee or burning the fingers. *Patent completed.*

604. C. MILLS. "Improvements in the action of pianofortes." Dated March 8, 1859.

Here the fly, as heretofore, is hinged at its lower end to a block fixed in a key of an instrument, as is also, as heretofore, pressed back by a suitable wire spring. At the front of the block is formed a stump which rises above the block, and the fly has a screw fixed into it at a point above the hinge. The screw passes through a hole formed in the stump in the block, and has mounted on it a button or stop which comes against the stump so as to stop the fly at the point required. *Patent completed.*

605. J. N. RYDER. "Improvements in preserving fruits, and in apparatus used for such purposes." Dated March 8, 1859.

Here the fruit is placed in a suitable vessel, to which heat can be applied by a steam jacket, and from which the air and vapour can be removed by an air pump. Around the upper edge of the vessel a hollow groove is formed to receive the lower edge of a dome-shaped cover. At the bottom of the hollow groove is a ring of vulcanised india-rubber, so that when the cover is pressed down by the external atmosphere the joint will be sufficiently air-tight. *Patent abandoned.*

606. E. DEANE. "Improvements in apparatus for the transmission of gas and other fluids." Dated March 8, 1859.

This consists in placing a screw, or threaded rod, or wormed plug within the bore of the pipe used for transmitting gas, &c., from the reservoir to the point of use. *Patent abandoned.*

607. W. CLARK. "Improvements in submarine telegraph cables." (A communication.) Dated March 8, 1859.

This consists in winding a copper wire spirally round the cable, and of placing one of the extremities of this wire in communication with one pole of the pile and the other extremity with the ground, whereby the inventor believes several advantages to be obtained. *Patent abandoned.*

608. B. M. BELLING. "Improved apparatus for hardening india-rubber for the bases of teeth." Dated March 8, 1859.

This consists of a wrought iron chamber of rectangular form, furnished with perforated shelves. The bases are subjected in this chamber to certain degrees of heat. *Patent abandoned.*

609. J. PILBROW. "Certain improvements in, or a new method or methods of, obtaining and applying motive power, a modification of which is also applicable for pumping or forcing liquids, gases, and fluids, as also for measuring liquids, gases, and fluids." Dated March 9, 1859.

Here a flexible and elastic tube is placed between two rollers, the rollers being pressed together with a force (by the agency of springs) sufficient to close the tube at the point where such rollers are placed. One end of the tube is left open to the atmosphere, and the other end is in connection with an air-pump. Upon the air being exhausted from the tube it will collapse; thus will the rollers be placed out of equilibrium as respects the pressure or elastic force of the tube on either side of them, and hence they will move over the collapsed part of the tube. *Patent abandoned.*

610. J. A. WILLIAMS. "Improvements in machinery or apparatus for cultivating land by steam power." Dated March 9, 1859.

This invention comprises various features in connection with agricultural implements. The specification is too elaborate for us to quote it at sufficient length for an intelligible abstract. *Patent completed.*

611. Sir W. G. ARMSTRONG. "Improvements in rifle ordnance and its projectiles." Dated March 9, 1859.

This invention was described at page 199, No. 39, Vol. 2, of the MECHANICS' MAGAZINE (New Series). *Patent abandoned.*

612. J. R. NICHOLSON. "New or improved machinery to be used in the manufacture of needles, a part or parts of which said machinery may also be used for pointing pins, and other like articles." Dated March 9, 1859.

This consists of machinery in which the wires to be operated upon are pointed by the action of grinders, the said wires being previously cut or ground of uniform length where necessary, and when the said wires are to be converted into needles, operated upon after the grinding processes by means of dies which produce the gutter and the impress of the eye of the needle. *Patent completed.*

613. J. ERWOOD and J. SKERTCHLY. "Improvements in the manufacture of glass, sand, and emery papers and cloths, and other similar articles used for like purposes." Dated March 9, 1859.

In these improved abrading papers and cloths, the patentee raises or depresses certain portions of their surfaces by embossing or otherwise, producing lines, patterns, indentations or other forms upon them in order to destroy their level character. The object is that in their use the portions highest in relief are brought in contact with the substance to be abraded first, and as these portions are gradually worn away, fresh and unworn parts of the papers or cloths are successively brought into action until the lowest part are finally worn out. *Patent completed.*

614. G. C. PEARCE. "An improvement in cornets, trumpets, trombones, and other like wind instruments." Dated March 9, 1859.

The object here is to reduce the number of bends in brass and other metal instruments, and to cause the air to travel through the same number of bends whether the keys are up or down. This the inventor effects by one bent or semicircular passage, and two straight passages in a moveable valve placed in a box or cylinder. By turning the valve in one direction the wind enters and returns by and through the bent passage, while on turning it in the other direction, the straight passages through the valve are opened to the passage of the wind. *Patent abandoned.*

615. J. S. RUSSELL. "Improvements in building ships and other vessels." Dated March 9, 1859.

This invention was described at page 199, No. 39, Vol. 2, of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

616. J. COOKE. "Improvements in apparatus for giving signals on railways and vessels, and other such like uses." Dated March 9, 1859.

Here an air tight vessel is filled with air by means of an air pump, and a whistle is blown by the action of the air therein. *Patent abandoned.*

617. A. V. NEWTON. "Improved machinery for rolling horse-shoe iron." (A communication) Dated March 9, 1859.

Here the inventor combines in a pair of rolls a groove and creasers, which, by their joint operation, exert pressure in a lateral as well as in a longitudinal direction, and thus produce, by a continuous operation, horse-shoe iron, which is concave on its upper side, thin on its inner edge, thick on its outer edge, creased on its under side, and gradually diminishing in width from heel to toe. *Patent completed.*

618. W. E. NEWTON. "Improvements in billiard tables." (A communication.) Dated March 9, 1859.

This consists, 1, in supporting the rail by rhomb-shaped studs which leave room enough in their centre for bolts to pass through, while they are bevilled down towards both ends, so that an open space is left between the bed of the rail nearly all the way round, so that a ball can be reached with a cue just as easily when it lies close up to the cushion as it can when it lies further from the rail. 2. In forming the pocket bows of the same pieces which form the rail, joining the same in the middle of the bows, and giving them a bevel underneath, so as to throw the balls down when played at the pockets, and yet keeping the pocket bow on a line with the top of the rail. 3. In a particular construction of the cushion, the object being to give a perfectly true angle. *Patent completed.*

619. H. FISHER. "Improvements in machinery or apparatus for cutting thin sheets of metal into strips, and for tempering sheets or strips of metal." Dated March 9, 1859.

This consists in preventing thin strips of metal from twisting or curling during the process of cutting them from the sheets by rotary cutters, by causing a bar to press the material upon the said cutters, which material also passes between rollers. Also in the use of rollers for keeping strips or sheets of metal at tension during the process of tempering. *Patent abandoned.*

620. J. C. MARTIN. "An improvement in the manufacture of cannon and small fire-arms, and of projectiles to be used with the same." Dated March 10, 1859.

This consist in forming a smooth chamber at the breech of the gun by increasing the diameter of the bore of a rifle to the depth of the grooves, or rather more so, and in length slightly greater than the projectile to be used; a chamber for the powder somewhat less than the bore may be formed at the breech of the previously-described chamber. The object of increasing the diameter of the bore at the breech is to admit at the mouth of the gun a projectile that shall on reaching the chamber expand and fill it, and be forced by the action of the powder into the grooves, closely and perfectly filling them as the gun is discharged. The projectile on reaching the chamber consists of two parts, viz., a conical plug of iron somewhat in the form of a sugar-loaf, and an outer

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moveable casing of lead or other suitable soft material. *Patent abandoned.*

621. J. Yuill. "Improvements in saddle-trees." Dated March 10, 1859.

Each saddle-tree or curb, according to this invention, is cast wholly in a solid piece, as near as can be to the ultimate bend required, and it is afterwards bent to the exact form necessary. *Patent completed.*

622. R. F. Woodward. "An improvement or improvements in the manufacture of certain kinds of scale beams and fittings used therewith." Dated March 10, 1859.

This relates to scale beams made of iron or steel, and consists in making them by the process of stamping instead of by forging. *Patent abandoned.*

623. H. Lodge. "Improved means of protecting ships, batteries, and other constructions or buildings from the effects of projectiles of various kinds." Dated March 10, 1859.

This consists in the use of corrugated sheets of metal. *Patent completed.*

624. J. H. Burton. "An improvement in breech-loading fire-arms." Dated March 11, 1859.

This consists in constructing the steel or iron breech-plug, so that the part coming in contact with the explosive force of the powder is separated from the main portion by interposing a cylinder or ring of copper or other suitable metal, and all are secured together by a screw or other device. *Patent abandoned.*

625. J. C. Haddan. "Improvements in casting mortars and cannon." Dated March 11, 1859.

This consists in causing the mould to revolve either during the time that the metal is being poured into it, or afterwards, until it has become partly or entirely solidified. *Patent abandoned.*

626. R. Hellard. "Improvements in reaping and mowing machines." Dated March 11, 1859.

The object here is to effect a better raising than heretofore of laid or beaten-down corn, and bringing it up into or towards the knives or cutting apparatus of the machine, and thus placing it in a more favourable position to its being cut, and further correctly disposed of, and this object is effected by the use of creepers made of iron or other suitable material. *Patent completed.*

627. S. Wheatcroft. "Improvements in the construction of goffering and rouching machines, in order to render them self-registering and self-indicating." Dated March 11, 1859.

This consists in appending apparatus to the goffering or rouching machine, so that it shall itself indicate when the determined quantity has passed through the machine, and also that it will, if necessary, cut off this goffered portion, which will then contain the predetermined length, and also that when necessary by additional indicating apparatus, it will show the amount of plain material that has passed through the machine in a given time. *Patent completed.*

628. N. Washburn. "A new and useful or improved machine for rolling tyres for wheels." Dated March 11, 1859.

This invention consists in a combination of a set of reducing rollers, a series of adjustable carrying rollers, and a frame or holder of the carrying rollers, supported so as to be capable of rising upward within the wheel-tyre in proportion as the diameter of the inner periphery of the tyre increases during the rolling of the tyre. *Patent completed.*

629. F. Clark. "An improved mode of, and apparatus for, cutting, drying, and preparing peat to be used as fuel, or for other purposes for which it may be usefully employed." Dated March 11, 1859.

Here the patentee cuts large slices of peat of about 3 feet wide, from 12 to 18 inches thick, and from 15 to 30 feet long by means of an apparaus which consists of a cutting tool of suitable form, and provided with a long handle or shaft. This cutting tool is worked by toothed or other suitable gearing. The slabs of peat having been pressed and solidified are put upon a travelling web made of metal, and passed into or slowly through long narrow drying chambers constructed of brick, stone, iron, &c. *Patent completed.*

630. A. V. Newton. "An improved construction of steam-engine, applicable also to the raising of water. (A communication.) Dated March 11, 1859.

This invention is not described apart from the drawings. *Patent completed.*

631. J. Cunliffe, F. Piggott, and G. Mallinson. "Improvements in the manufacture of ornamental woven fabrics." Dated March 12, 1859.

Here fabrics are woven by any suitable mechanism with the weft floating over the warp, so as to leave races, and the ornamental velvet effects or patterns required are produced by cutting parts of the races and leaving the other parts uncut. *Patent completed.*

632. W. E. Newton. "An improvement in endless chain propellors for boats and other vessels." (A communication.) Dated March 12, 1859.

This consists in attaching the chains to the buckets of endless chain propellers at points in, or nearly in lines passing longitudinally or horizontally through the centres of the faces of the buckets, and in bracing the so attached buckets to the links of the chains by diagonal braces attached to opposite sides of the buckets, and on opposite sides of such central lines. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated June 20, 1859.

1478. L. D. Dewey. Improvements in spring seats for chairs, sofas, couches, carriages, and other similar articles. (A communication.)

Dated July 4, 1859.

1589. H. C. Howells and J. C. Howells. Improvements in the mode of registering the number of persons entering or leaving public conveyances or places of public resort, and of determining the value of the entry or fare.

Dated Aug. 27, 1859.

1957. J. Philp. Improvements in the manufacture of soap. (A communication.)

Dated Aug. 29, 1859.

1959. J. Whitworth. Improvements in ordnance, fire-arms, and ammunition.

1964. J. Edwards. Improvements in the manufacture of buttons.

Dated Aug. 31, 1859.

1989. R. A. Brooman. Improvements in treating auriferous and argentiferous ores and substances. (A communication.)

Dated Sept. 3, 1859.

2014. W. Suffield. Improvements in the manufacture of artificial teeth, and in machinery to be employed in the said manufacture.

2016. G. Davies. Improvements in printing, and in apparatus connected therewith. (A communication.)

Dated Sept. 7, 1859.

2038. E. R. Dann and E. Goldschmidt. Improvements in the manufacture of bonnet fronts or lappets.

2040. H. Jones. Improvements in breech-loading fire-arms.

2042. J. L. Jullion and G. Pirie. The manufacture of gelatine, and apparatus to be employed therein.

2044. A. V. Newton. An improved manufacture of metallic strips or bands applicable to ladies' skirts. (A communication.)

2048. W. Rothwell and T. Watson. Improvements in screw gill-boxes.

Dated Sept. 8, 1859.

2050. T. O. Small. Improvements in the stereoscope, by means of tinted media, and by the application of the pulley and lever, or spring, in changing the lights.

2052. J. H. Johnson. Improvements in cocks and valves. (A communication.)

2054. J. Tandy. Improvements in locomotive and other steam-boilers.

2056. G. Gowland. Improvements in nautical and surveying instruments for measuring angles.

Dated Sept. 9, 1859.

2060. S. Worssam. Improvements in sawing machinery.

2062. W. E. Gedge. Improvements in the manufacture of nails. (A communication.)

2064. A. V. Newton. Improvements in the process of, and machinery for, manufacturing hat bodies. (A communication.)

Dated Sept. 10, 1859.

2066. A. Smith. Improvements in strengthening umbrella and walking stick handles, and other articles or details wherein the cross or transverse grain of wood or other material is subject to strains.

2068. W. Ross. Improved apparatus connected with the discharge of liquids.

2069. E. J. Mallett. Improvements in axles.

2070. T. J. Perry. An improved construction of hot air oven.

Dated Sept. 12, 1859.

2076. J. Eason. Improvements in the manufacture of buff or losh and other oiled leathers.

2078. W. H. Morrison. Improvements in the manufacture of bonnet and cap fronts, and in the means or apparatus employed therein.

2080. J. Mason. An improvement in boxes or cases and cards to contain or hold pens.

2082. W. Elliott. Improvements in the manufacture of African or Guinea rods.

Dated Sept. 14, 1859.

2091. C. G. Gumpel. Improvements in the application of motive power to the propelling of vessels.

2093. J. P. Kennedy. Improvements in steam-boilers.

2095. C. Beslay. Improvements in preparing and obtaining printing surfaces with designs sunk as also in relief.

2097. J. S. Slocum. Improvements in projectiles, suitable for ordnance. (A communication.)

Dated Sept. 15, 1859.

2099. J. Robinson. An improved agricultural implement.

2101. J. Brière. Improvements in railway breaks.

2103. H. Winter. A machine or apparatus for lifting and weighing loaded sacks, and also merchandize.

Dated Sept. 16, 1859.

2105. J. W. Hadwen. An improvement or improvements in apparatus or machinery used for drawing fibrous substances or material in any of the processes or machines for preparing to be spun, or for spinning the same.

2107. N. Heckford. A method of purifying the Thames and other rivers, and of treating night soil.

2109. W. E. Newton. Improvements in machinery for forming hat bodies. (A communication.)

2111. H. Jackson. Improvements in fire-bars.

Dated Sept. 17, 1859.

2113. J. Luis. A new brick and tile-making machine. (A communication.)

2115. J. Luis. Further improvements in breaks for railway carriages. (A communication.)

2117. J. Luis. A slip bridle for stopping runaway horses. (A communication.)

2119. J. Luis. An improved disc and lantern signal with double repeaters. (A communication.)

2121. S. N. Rodier. Improvements in the regulation of gas to burners, which he calls "Rodier's regulating gas valve."

2123. A. J. Norman. Paving roads and surfaces.

Dated Sept. 19, 1859.

2125. F. N. Gisborne. Paying out submarine telegraph cables.

2127. W. Robertson and J. Tweeddale. Improvements in hydrostatic jacks, or lifting apparatus. (A communication.)

2129. J. Wright. Improvements in the construction of carriages, coaches, omnibuses, and other such like conveyances. (A communication.)

2131. P. Fairbairn. Improved machinery for finishing the teeth of spur and other gearing.

2133. R. A. Brooman. Improvements in elevators or lifts for hotels, warehouses, and other structures. (A communication.)

2135. L. Engler and E. F. Krauss. A new or improved system of insulators for electric wires.

Dated Sept. 20, 1859.

2139. W. Weild. Improvements in fluted rollers used in machines for preparing, spinning, and doubling cotton, wool, flax, silk, and other fibrous materials, and in the manufacture of such rollers.

2141. J. Beads. Improvements in machinery or apparatus for spinning cotton, wool, and other fibrous substances, part of which improvements is applicable to other purposes.

2143. W. E. Newton. Improvements in projectiles. (A communication.)

2145. E. Collier. Improvements in ear dilators.

Dated Sept. 21, 1851.

2147. H. Corless. Improvements in apparatus for washing, wringing, and mangling.

2151. W. E. Newton. An improved mode of, and apparatus for, condensing the waste steam of marine engines. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

2154. E. B. Dimock and J. H. Baker. A new and useful improvement in mechanism or apparatus for drying woollen or other cloths. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Oct. 4, 1859.*)

1240. J. Valda. Stud-fastenings.
1244. G. J. Parfitt. Gas burners.
1253. J. R. Scartliff. Lubricating cans.
1261. J. Knowles. Power looms.
1280. J. Gibbs. Treating coal, &c.
1282. G. Hadfield. Heating and evaporating.
1290. E. Maw. Metallic bedsteads.
1298. J. Webster. Gauges.
1304. G. F. Chantrell. Charcoal kilns.
1306. J. Draper. Indices.
1311. W. Weild. Pile fabrics.
1314. L. Farrence and B. Subra. Gas lighting.

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1315. H. N. Nissen. Indexes.
1316. G. Hadfield. Casks.
1328. J. Bruce. Drills.
1331. O. Maggs. Harrows.
1332. W. Green. Treating sugar.
1344. G. H. Smith. Sewing machines.
1345. P. Gambardella. Obtaining motive power.
1348. F. and A. Roberts. Cultivating land.
1351. F. W. Saltonstall and A. Bush. Dredging.
1363. R. W. Sievier. Smelting.
1365. R. Mushet. Iron and steel.
1379. C. James. Railway chairs.
1395. C. de Bergue. Shearing metal. (Partly a communication.)
1402. W. Burness. Steam-culture machinery.
1436. E. J. Maumené and V. Rogelet. Potash.
1509. C. F. and C. J. Varley. Electric conductors.
1522. P. Faure and J. Pernod. Madder.
1737. J. Hinks and G. Wells. Dress fastening.
1757. T. Culpin. Water-closets, &c.
1799. R. A. Brooman. Mills. (A communication.)
1820. E. T. Hughes. Chenille. (A communication.)
1886. W. Leatham. Screw throttle valve.
1916. R. A. Brooman. Spinning. (A communication.)
1985. A. Smith. Cocoa nut fibre.
1998. P. Wright. Anvils.
2059. J. G. N. Alleyne. Wrought iron beams.
2064. A. V. Newton. Hat bodies. (A communication.)
2071. T. G. Gutch. Copying books.
2080. J. Mason. Cases and cards for pens.
2081. H. G. Collins. Printing blocks and inks.
2099. W. E. Newton. Drying fabrics. (A communication.)
2109. W. E. Newton. Hat bodies. (A communition.)
2111. H. Jackson. Fire bars.
2131. P. Fairbairn. Teeth of gearing.
2154. E. B. Dimock and J. H. Baker. Drying cloths. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Sept. 29, 1859.

797. J. Cartwright.
798. C. P. Coles.
801. W. and E. Smith.
807. A. Morton.
813. D. K. Clark.
814. F. P. A. Auburtin.
822. Y. Thomas.
824. A. Ripley and J. Roberts.
832. M. Coupland.
834. T. Williams and J. H. Fuller.
836. J. Eccles.
840. J. H. Burton.
843. C. Russell.
844. M. A. Crooker.
846. E. Morewood.
848. A. Shanks.
850. E. Fairburn.
852. F. C. Bakewell.
853. G. F. Chantrell and E. Dutch.
855. J. Hetherington, T. Webb, and J. Craig.
861. J. A. H. Ballande.
862. W. Owen.
864. J. Scoffern.
865. D. Moseley.
871. J. Garrett.
873. J. T. Pitman.
878. M. A. F. Mennons.
880. N. A. Grumel.
883. W. Henderson.
885. E. R. Handcock.
886. T. Spencer.
891. J. H. Johnson.
895. W. E. Newton.
934. J. Gillett.
957. W. E. Newton.
960. H. Harrison.
982. W. Parsons.
987. I. Dutton, R. Martin, and T. Phillips.
991. A. V. Newton.
1046. R. Main.
1051. J. H. Johnson.
1090. C. H. G. Williams.
1100. W. Sellers.
1134. W. E. Newton.
1135. W. E. Newton.
1205. A. V. Newton.
1418. H. J. Nicoll.
1529. J. Boden and W. Clark.
1538. G. Dawes and C. J. Carr.
1580. T. J. Hart.
1587. J. Hollingworth.
1627. D. Mathews.
1639. C. Iliffe.
1658. A. Cooper.
1720. S. A. Bell and J. Black.
1738. J. Gillott and J. Morrison.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2267. F. Ransome.
2279. R. Morrison.
2293. J. Dauglish.
2305. E. Hardon and J. Henry.
2319. G. F. Wilson and A. I. Austen.
2320. D. O. Boyd.
2334. H. Mackworth.
2335. A. Dunlop.
2348. G. F. Wilson.
2349. W. Marriott and D. Sugden.
2378. F. A. Gatty.
2413. G. Hazeldine.
2443. L. J. Pomme de Mirimonde.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

6. M. Poole.
9. G. Green.
16. M. Poole.
19. M. Poole.
24. M. Poole.
28. M. Poole.
30. M. Poole.
33. M. Poole.
37. M. Poole.
41. J. Barrans.
43. M. Poole.
56. J. Finlay.
57. J. J. Macdonnell.
77. S. Soulby.
96. H. Bridson.
103. C. Lungley.
123. R. Whytock.
142. H. B. Barlow.
156. J. Brown.
160. J. Burch.
163. M. Poole.
172. J. Jobson.
184. J. Needham.
187. A. Miller.
214. T. Kennedy.
237. H. Jäger.
246. G. H. Cottam.
251. A. E. L. Bellford.
272. J. Hill.
275. A. R. de Normandy.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Sept. 30, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
499	0 3	519	0 3	532	0 3	543	0 7	551	0 4	565	0 3
503	1 3	520	0 6	533	0 3	544	0 10	555	0 3	566	0 7
505	2 9	521	0 8	534	0 3	545	0 3	556	0 6	567	0 3
507	0 7	523	0 6	535	0 3	546	0 3	557	0 9	568	0 3
508	0 3	524	0 5	536	0 3	547	0 7	558	0 10	569	0 3
509	0 7	525	0 7	537	0 6	548	0 3	559	1 10	570	0 6
510	0 3	527	0 6	538	0 3	549	0 3	560	0 6	571	0 3
512	2 8	528	0 11	539	0 10	550	0 7	561	0 3	572	0 3
513	1 4	529	0 7	540	0 3	551	0 5	562	0 6	573	0 7
514	0 7	530	0 9	541	0 6	552	0 3	563	0 3	575	0 9
515	0 3	531	0 10	542	0 3	553	0 3	564	0 3	579	1 0

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS IN VITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

RAILWAY, *Manchester, Sheffield, and Lincolnshire.*—The directors will receive tenders for construction of a branch railway commencing near the town of Hyde, and terminating near Murple, Chester. Plans and specifications, Oct. 13, at the office of Mr. John G. Blackburne, C.E., Oldham, from whom all necessary particulars. Tenders to Mr. Edward Ross, Secretary.

RAILWAY PIER, *Sittingbourne and Sheerness.*—For construction of a pier at Queenborough, Isle of Sheppy. Drawings, &c., and form of tender, at office of the engineer, Mr. J. C. Birkinshaw, 22 Abingdon-street, Westminster. Tenders to Oct. 10.

SEWER WORK, *St. Luke, Chelsea.*—For the execution of general works connected with the sewers and drains, according to a schedule of prices at the office of the vestry, Manor House, 111 King's-road, Chelsea. Contract for twelve months. Copies of the schedule, and of the contract, and form of tender, at the vestry offices, upon payment of 10s., to be returned to parties tendering. The vestry reserve the right of making special contracts. Tenders at the offices, Oct. 10.

WIDENING BRIDGE, *Droylsden.*—The Board of Surveyors for the township of Droylsden are now ready to receive tenders for the widening of Fairfield Bridge, in the said township. Plan and specification, Mr. James Hadfield, assistant surveyor, Ashton-lane, Droylsden, to whom tenders, 15th Oct.

CONGREGATIONAL CHAPEL AND SCHOOLS, *Cheadle.*—Conditions, plans, and specifications, Oct. 11, Mr. Isaac Neild, 24 Brown-street, Manchester. Tenders to the Building Committee at Mr. Nield's office, Oct. 19, 4 p.m. Information and bills of quantities, Messrs. Poulton and Woodman, architects, Reading; London-road station, Manchester; 12 a.m., Oct. 27.

CEMETERY CHAPELS, *Great Malvern.*—For the erection of the proposed chapels and buildings for the cemetery of Great Malvern. Plans, &c., vestry room of the Priory Church, by applying to the Churchwardens. Further information of the architect, Mr. W. H. Knight, Cheltenham. Tenders to the Churchwardens, Oct. 12.

CEMETERY CHAPELS, *South Weald, Essex.*—For the erection of a chapel, lodge, and fences, and the laying out the intended burial ground, situate in the parish of South Weald, near the road leading from Brentwood to Warley. Plans, &c., at the office of Mr. T. E. Knightley, 25 Cannon-street, London. Tenders to Oct. 18.

SCHOOLS, *Pelston, in Nottingham.*—For the erection of boys' and girls' schools with offices. Drawings, &c., also bills of quantities on application at the office of the architect, Charles H. Edwards, 4 St. James's-terrace, Camden Town, N.W., or at the rectory, Pelston. Tenders to October 14.

WAREHOUSE, *Great Malvern.*—For pulling down certain premises at No. 5 Copenhagen-street, and erecting a warehouse on the site thereof. Plans, &c., at the vestry-room of the Priory Church, on application to the churchwardens. Further information from the architect, Mr. W. H. Knight, of Cheltenham. Tenders to Oct. 12.

CONTRACTORS' RAILS, *London.*—Must be 35 lbs. to 40 lbs. Apply J. B. Brown and Co., 18 Cannon-street, City, London, E.C.

MAGISTRATE'S ROOM AND POLICE STATION, *Daventry, Northamptonshire.*—For the erection of a magistrates room and police station at Daventry. Plans, &c., at the office of Mr. James Milne, county surveyor, Northampton. The tenders must be made in two parts, one stating the amount for the police station, and the other the amount for the magistrates' room. Tenders to Oct. 17.

GAS FITTINGS, *Stone, Staffordshire.*—The churchwardens of Stone parish church are desirous to receive specifications and tenders to contract to supply and set up the necessary fittings for lighting the church with gas in the most approved manner. The area of the church is 70 feet by 54 feet; height, 34 feet; roof flat. No pillars or columns, saving the iron ones, which support the galleries on three sides. Address, the churchwardens.

WORK AND MATERIALS, *St. Luke, Chelsea.*—For the execution of works and the supply of materials connected with the trades of paviors, masons, stone merchants, and others, in the parish of St. Luke, Chelsea, as may be required and directed. Further particulars and forms of tender of Mr. Charles Lahee, vestry clerk, offices, Manor-house, 111 King's-road, Chelsea; where tenders, Oct. 10.

IRON BOREINGS AND TURNINGS, *War Office.*—Tenders will be received at this office, on or before the 10th October, for the purchase of iron boreings and turnings from the Royal gun factories, Woolwich. Tenders must be made upon the proper printed form, which may be obtained at this office, or to the superintendent of the Royal gun factories, from whom all information respecting the iron may be obtained. All tenders to be addressed to the Under Secretary of State for War.

OILS, *Navy.*—For supplying Her Majesty's several dockyards with Gallipoli oil, linseed oil, and English or Russian white tallow. Distributions of articles and forms of tender, Somerset-place. Tenders with presence of principal or agent; and bond-letter to the extent of £25 per cent. of the tender, two o'clock, Oct. 11.

OIL, *Navy.*—For supplying Her Majesty's several dockyards with train or pilchard oil, and pale seal oil. Distributions of the oils and forms of the tenders at the office of the Storekeeper-General of the Navy, Somerset-place. Tenders, Oct. 18, 2 p.m., per principal or agent. One bond for £100 for the due performance of the contract for train or pilchard oil, and £150 for pale seal oil.

CAST-IRON PIPES, *Somerset.*—Some cast-iron pipes wanted for hot water, gas, and steam. Also rain, gutter, and wall pipe. Apply to Mr. W. Bishop, iron and beam foundry, Wellington, Somerset.

PLANS FOR CHURCH, *Stroud.*—For designs, specifications, and estimates for rebuilding the parish church, Stroud. The church to contain 1,500 sittings, 500 of which are to be free, and the cost not to exceed with the old materials £4,000. The old tower and spire to remain; the south, north, and west walls to be built on their present foundations, and if necessary, south, north, and west galleries to be constructed. The chancel to be enlarged, and the floor of the church and chancel to be raised. An organ chapel and vestry to be constructed at the side or sides of the chancel. A premium of £20 will be given for the approved design. Plans to be forwarded to Messrs. Sidney, Biddle, and George Edwards, Hon. Secs., Stroud, by Nov. 1.

BOILERS INSPECTOR, *Huddersfield.*—An inspector for the Huddersfield Steam Boiler Association who thoroughly understands steam engines and boilers. Salary £120 per annum. Application, with testimonials, to Mr. Daniel Cocking, Secretary, 13 Albert-buildings, New-street, Huddersfield.

ROLLER.—For rolling merchant iron, guide iron, and hoops. Apply to Mr. Hunt, Prince of Wales Iron Works, Millwall, Poplar, London.

PRICES CURRENT OF METALS.

London, Oct. 7th, 1859.

IRON:		£ s. d.		£ s. d.	Dis.
Rails in Wales and North of England	pr. ton	6 0 0	to	0 0 0	per ct.
Welsh Bars, in Wales	"	5 17 6	"	6 0 0	nett
Staf. Bars, at the Works	"	7 0 0	"	7 10 0	2½
" Hoops	"	8 0 0	"	8 10 0	2½
" Sheets, Singles	"	8 10 0	"	9 0 0	—
" Nail Rods	"	7 0 0	"	7 10 0	—
" Boiler Plates	"	8 10 0	"	9 0 0	—
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2 11 6	"	2 11 9	nett
Do. No 1, Good Brands	"	2 12 0	"	2 14 0	—
Scotch Bars	"	7 10 0	"	8 0 0	—
Swedish Bars, in London	"	11 10 0	"	11 15 0	—
COPPER:					
Sheet and Sheathing	per lb.	0 0 12	"	0 0 0	—
Tough Cake and Tile	pr. ton	107 10 0	"	0 0 0	—
Best Selected	"	110 10 0	"	0 0 0	—
Australian	"	109 10 0	"	0 0 0	—
South American	"	101 0 0	"	110 0 0	—
Yellow Metal Sheathing	per lb.	0 0 10	"	0 0 0	—
STEEL:					
Swedish Keg	pr. ton	19 0 0	"	19 5 0	—
" Faggot	"	21 0 0	"	21 10 0	—
TIN:					
English, Block	p. cwt.	6 16 0	"	0 0 0	2½
" Bar	"	6 17 0	"	0 0 0	—
Foreign, Banca	"	7 2 0	"	7 3 0	nett
" Straits	"	6 19 0	"	0 0 0	—
TINPLATES:					
Charcoal, I.C.	pr.box	1 11 0	"	1 13 6	—
Coke, I.C.	"	1 5 6	"	1 8 6	—
LEAD:					
Pig, English	pr. ton	22 5 0	"	22 10 0	2½
" Spanish	"	21 15 0	"	22 5 0	—
Sheet	"	23 0 0	"	23 5 0	—
SPELTER:					
On the spot	"	20 0 0	"	20 5 0	nett
For arrival	"	20 5 0	"	0 0 0	—
ZINC:					
English Sheet	"	27 0 0	"	0 0 0	2½
QUICKSILVER	pr. btl.	7 0 0	"	0 0 0	—

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 14, 1859.

SCIENCE AND THE PRINCE CONSORT.

THERE are two features very strongly imprinted on the age in which we live. For one thing our time is marked by a very high development of humanity. We were greatly impressed by this in a recent visit to one of our public lunatic asylums. We entered a spacious, airy, handsome edifice, in the depth of a rural region, looking out on wood, meadow, and river. The physician in charge of the whole institution, a keen, cultivated, humane gentleman, and of an activity bright and incessant as a bird's, led us through all the wards, where we saw some six hundred insane persons. Numbers of them were peacefully employed, at washing, or cooking, or baking. None of them had any restraint on them beyond the eye of the attendant, and the walls of the building. All was cleanly and handsome that met their eye; their bed and board were of the wholesomest and best. The very lady of the house, the physician's wife, was just as devoted to these poor insane persons as he himself, — constantly amongst them, and expressing intimate affection for several of them; entertaining them with music on the Sunday, and in winter evenings getting up concerts and dramatic exhibitions for them. Altogether, the scene was a living symbol to us of our time, and made us feel afresh that the world has never before seen so high a development of humanity as that which meets the eyes of the present generation.

The other characteristic of our time to which we refer is its boldness, comprehensiveness, and certainty of mental inquiry, which expresses itself in its favourite term—science. We had a notable example of this in the speech of the Prince Consort at Aberdeen, which we reprinted in our journal a fortnight ago. It was a fine specimen of the best mind amongst us. What choice, pure English the language was, and of such delicate precision and beauty. What graceful personal modesty the speaker showed. How full the discourse was of the old German solidity and seriousness of purpose, that marks all the German people, whether in the old Fatherland or in Angleland. The term science in this address is made to embrace the whole range of the human mind. There are three objects of man's contemplation and inquiry—Nature, Man, God. The human mind has two methods of working — analysis and synthesis. It dissects into parts, observes, examines, reasons about each part; or intuitively it grasps the law that binds and controls the parts and knits them into a whole. All follow this method, says the Prince—the child, the man of mere practical instinct, or the philosopher. The child, as soon as his first surprise and ecstasy at the new universe subside a little, begins to ask the *how* and *why* of things. He practises his analysis by pulling his toy to pieces to discover how it works; or he performs a splendid generalisation; as, for example, when the fire burns him he affirms to himself that fire burns in every instance, at all places and times, though he has only experienced one instance of its burning power. The practical man is instinctively impelled to philosophise, in his rough, home-spun method, on the facts he is brought into contact with. But the philosopher, by stronger instinct and by conscious self-determination, directs his eye to every part of the great All.

Science, the Prince hints, has been of slow growth in England, partly because we English are so wedded to what is immediately useful, what immediately shows a return in pounds, shillings, and pence; and partly from our excessive devotion to antiquity, that "till of late "has almost systematically excluded from our "school and university education" the great subjects and the results of modern inquiry, while it has given to antique things that liveliness of interest we feel all through life in the subjects we studied in early years.

The illustrious speaker lays great stress on the absence of all professionalism and officialism from science. Knowledge in his eyes has no aristocracy or priesthood. Its genuine students are not "a secret confraternity of men jealously "guarding the mysteries of their profession"; their activity is "the republican activity of the "Roman Forum." But if boldness and freedom, the Prince reminds us, are the characteristics of the philosopher, equally so is reverence. The more he explores the more he becomes aware of "the boundlessness of the universe, whose con- "fines appear ever to retreat before our finite "minds." True thinkers are "not conceited "pedants, wrapped up in their own mysterious "importance, but humble inquirers after truth; "not God-defying Titans, but reverent, pious "pilgrims towards a Holy Land—God's Truth "—God's laws, as manifested in His works, in "His creation."

Servility to mere rank as such we have supreme contempt for; but we confess to an unusual joy when a man in a high place has a higher light in him than those in low and even in high place around him; and such we conceive to be in this Prince's mind.

THE GREAT EASTERN.

THE trial trip of the Great Eastern has at last been made without accident, misadventure, or failure of any kind. By the untiring activity and exertion of the contractor, the injuries caused by the late explosion were so far repaired as to admit of the trip being entered upon on Saturday last. On reaching the ship on the morning of that day we were happy to observe that her condition was much improved in many ways. Sails were bent upon the yards and gaffs; the steering wheel was furnished with chains rove so as to increase the control of the steersmen; the water-tight bulkheads were as sound and complete as was necessary; the staffs of the two engine-rooms and boiler departments were made up and well organized; the captain had a crew in whom he appeared to possess confidence; and altogether the ship presented a far more satisfactory aspect than on the occasion of the trip from the Thames to Portland. And this is a proper place for remarking that the materials and workmanship which have been supplied by Mr. Scott Russell throughout the equipment of the ship are of the very best kind—a circumstance which is not always observable in contract work. The firms to whom he committed the masting, rigging, and sail-fitting, for example, under sub-contracts, are among the most eminent in England—the Messrs. Ferguson and Co., Messrs. Westhorp and Co., Messrs. J. T. Hall and Co., and Messrs. J. and E. Wright—and we are enabled to state, on the authority of most of the heads of these firms, that Mr. Russell has rigidly enforced but one condition upon them, viz., that everything supplied should be of the very best kind manufactured by them. The masts and spars, standing rigging, running gear, and sails of the ship all attest the faithfulness of the sub-contractors to this condition, and reflect the highest credit upon Mr. Russell, the general contractor for the whole.

But notwithstanding the altered condition of things to which we have before alluded, it must not be understood that the state of the ship was unsusceptible of further improvement. On the contrary, we think the services of some of the sub-contractors—all of whom were notably ready to lend their aid at any sacrifice to themselves—might have been somewhat further continued with advantage. Had Mr. Hall had an opportunity of finally adjusting his sails to his own satisfaction their set would doubtless have been improved; and Mr. Westhorp's great experience in equipping vessels might have been further applied to equally good purpose; but, as we have on former occasions urged Captain Harrison to take the ship in his own hands, and as Mr. Scott Russell had strenuously pressed the Company to keep their engagements with the public by proceeding on the trial trip on the 8th inst., it would probably be unfair to charge the Captain with any remissness on these points. For this cause we also refrain from noticing some other matters which, to a certain extent, challenged criticism when we entered the ship on Saturday.

One of the most important and satisfactory consequences of the late explosion was visible in the absence of all water-heating cases around the funnels; these have been altogether done away with, the air now flowing freely through the space contained between the funnels and the casings. Thus, all accidents like the late one are rendered impossible in the ship for the future, although security has, of course, been gained at the expense of a certain amount of economy. The slight injury which the boiler sustained has also been repaired. This is so small a matter that it would not need another word but for the exaggerated importance which some writers for the newspapers have attached to it. These gentlemen tell us that the contractor is at issue with the Board of Trade Surveyor and the Directors of the Company on this point, the latter contending that the injured plate should be replaced by a new one, and the former that the repair has been properly made already by riveting a piece of plate over the injured part. We think the contractor is quite right. The word "patch" is all that alarms those who think otherwise—as if a riveted boiler itself is not a mere agglomeration of patches! No sensible man would think of unriveting a plate from a boiler, and causing all that weakness and liability to leak which may result from doing so, simply to repair a slight crack which does not even extend wholly through the metal, and which can be as effectually repaired by riveting a piece of plate over it. As to the remainder of the repairs which the explosion rendered necessary, it is sufficient to say they are fast approaching completion.

We come now to the trial trip; and at the outset would warn our readers against expecting too much, in the shape of data, from it, as regards either the speed of the ship or the economy of her boilers and engines. An ordinary ship must be subjected to many trials under various circumstances before final conclusions on these subjects can be arrived at; and in the case of the Great Eastern, which is an extraordinary ship in many respects, it will doubtless take a considerable time—perhaps a voyage or two across the seas—before her capabilities are properly understood. A deeper immersion, a different trim, an improvement in the form of the screw, an increase or decrease in the reefing of the paddle floats, greater experience on the part of the firemen and stokers —all these and some other things may tend to modify her speed hereafter. But whether a greater speed is ever to be attained or not, the

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late trial trip was very satisfactory. For a short time on Sunday morning the speed predicted from the first by her builder—fifteen knots an hour—was attained. The fore and aft sails were set at the time, it is true; but the moderate breeze which was blowing could have added nothing to the speed derived from her engines, the only advantage of the sails being that of steadying the ship as she crossed the swell that beset her in her passage from the Scilly Islands to the Old Head of Kinsale in Ireland. When this speed was reached the screw engines made from 40 to 41, and the paddle from 11 to 12 revolutions per minute, the steam [boiler] pressure being about 22 lbs. We have no doubt whatever that if tried at the measured mile under moderately favourable circumstances it will be found that her speed will fall nothing short of the fifteen knots which she has already made.

There can be no question that this result is most satisfactory, and when the dimensions and horse-power of the ship are considered will be seen to surpass everything hitherto attained. The famous Persia, which is of but little more than one-sixth of the registered tonnage of the Great Eastern, and yet has more than one-third of her nominal power,* has made no more than fifteen knots, we believe, while in the tabulated lists of the Royal Navy† we find no vessel of anything like the same efficiency. The Admiralty there give us two formulæ by which they test the relative merits of steam-ships; the former involving the speed, midship section, and indicated power; the latter involving the weight instead of the midship section. To apply these tests to the Great Eastern we require of course to have her indicated power, midship section, and weight, and these we are able to supply with a sufficiently near approximation to the truth for our present purpose. Before leaving the ship we ascertained that the total indicated power, developed when the engines did their best, was about 7,200-horse power. We have further found by approximate calculations that with the draught of water with which the ship left Portland (25 feet aft, 21 feet forward, mean 23 feet) her midship section must have been about 1,600 square feet. Further, her weight must have been at least between 17,000 and 18,000 tons—say 17,500. We know that this must be near the weight, and at any rate cannot be in excess of it, because the mere iron in the hull weighs 8,000 tons, the engines and boilers about 2,000 tons (reckoning the weight three-fourths of a ton per nominal horse-power), and there were 6,000 tons of coals on board, in all 16,000 tons. To this we add 1,500 tons only for the weight of woodwork, masts, spars, and rigging, paddle wheels and screw, water in boilers, and everything else on board, which certainly cannot weigh less than that amount. Taking, then, these quantities—the speed 15 knots, the midship section 1,600 square feet, the displacement 17,500 tons—and substituting them in the two Admiralty formulæ successively, we get for the Great Eastern's characteristic numbers 750 and 316 respectively. Now, none of the Admiralty vessels reach such numbers as these. We have the Agamemnon giving 664, the Miranda 780, the Tribune 686, the Algiers 687, the Simoom 688, the Desperate 697, the St. Jean D'Acre 701, the Princess Royal nearly 725, and the Cruiser nearly 728, by the first formula; and we have the St. Jean D'Acre giving 201, the Tribune 202, the Princess Royal 203, the Cruiser 220, the Desperate 224, the Simoom 240, and the Miranda no less than 247 by the second formula; but the very best of these fall, as will be seen, considerably short of the Great Eastern's numbers in both cases.

Still, as we said before, we believe the Great Eastern will yet prove herself capable of more than she has hitherto accomplished. And we find reason for believing this in the results of a few experiments which were made off Holyhead on Monday before we entered the harbour. The ship was there tried first under paddles alone and then under the screw alone, and although the one propeller had in each case to drag or force the other through the water, speeds of no less than 8½ and nearly 9 knots respectively were attained. We watched these experiments very closely, carefully noting the periods at which the engines were stopped and the log cast, and whatever statements may have appeared elsewhere we assert, on our own carefully-acquired knowledge, that after the screw had stopped entirely for several minutes the paddles (driven by 1,000-horse power engines) propelled the huge vessel and dragged her screw at no less than 8½ knots, measured with the log by the ship's officers; and that when the paddles had nearly (but not altogether) come to rest the screw (driven by 1,600-horse power engines) propelled her at 9 knots. Now, if the screw had been properly immersed, it would have produced a considerably higher speed than the paddles, or should have done so, seeing that its engines were more powerful than the others by 60 per cent.; and there can be little doubt that when the ship is brought to a deeper draught of water aft, the screw will contrast less unfavourably with the paddles. It is only due, however, to Mr. Scott Russell to say that he took no part in bringing on the trials which terminated so favourably for his paddle-wheel engines; on the contrary, he objected to making them at all during the late trip, because time could not be afforded for disconnecting the paddles and the screw from their engines so as to give a fair opportunity for each propelling apparatus to display its full power; and in doing so he incurred the displeasure of some of the passengers—newspaper reporters and others—who of course understand such matters infinitely better than men like Messrs. Blake, Langdon, Scott Russell, and others. We are sorry to have to add that even Captain Harrison might with advantage have shown less disposition to interfere with such matters as the reefing of the paddle floats and other engineering points, in reference to which he evinces no unusual skill or knowledge. It is satisfactory, however, to know—and we state it from an intimate acquaintance with all the facts of the case—that Mr. Blake (the representative of the Boulton and Watt firm) and Mr. Russell, have maintained the most complete cordiality possible throughout the harassing transactions of the last few months. The engineers themselves being agreed on all points, it does not much matter whether people who know nothing of engineering think them right or wrong.

It is very gratifying to know that both the engines of the great ship work most admirably. Owing to a little looseness of the connecting rods upon the crank pin, the screw engines at present make more noise than is desirable, and if the defect were not remedied, would doubtless derange themselves prematurely; but a very little expense and trouble will suffice to make all as it should be in this respect. On Saturday evening, the escape valve of one of the paddle cylinders was held partially open for a few minutes by mud or sediment of some kind, but this was speedily removed without stopping the engines; and, on Monday afternoon, a similar thing occurred in one of the cylinders of the screw engines, and made it necessary to stop them for a very few minutes. But for these occurrences, which were so insignificant as to deserve mentioning only for the sake of strict accuracy, it might have been said that both engines ran the whole forty-eight hours, from Portland to Kinsale, and thence to Holyhead, without ever stopping or manifesting the slightest tendency to derangement. This is a result upon which Messrs. Blake and Langdon (Boulton and Watt) and Mr. Scott Russell deserve the warmest congratulations. The paddle engines having, of course, a speed much inferior to that of the screw engines, doubtless offered a better chance of success to their constructor than the others, but they are nevertheless a marvel of mechanical construction. The four ponderous cylinders, each weighing with its piston and piston rod no less than thirty-eight tons, and moving with a stroke of fourteen feet, worked with a perfection which elicited continual admiration from the most experienced practical men on board the ship.

As to the sailing qualities of the Great Eastern, the trial trip showed absolutely nothing. Every scientific man must know perfectly well that when a ship is steaming at the rate of from fourteen to fifteen knots per hour with a moderate breeze considerably before the beam, no increase of speed can possibly result from hoisting fore and aft sails. By sheeting the sails well home, as was done on Sunday, you may, of course, find them of great service in steadying the ship, as we did; but even this effect is, to a great extent, due to the vessel's own motion through the air, which motion cannot, of course, be available as a source of speed. At the same time, there can be but little doubt that when put under an amount of sail proportionate to her size, the great ship will be second to none as a sailing craft. Her behaviour, so far as it has been observed, has given great satisfaction. As to her steering, it may be said that in running at full speed up the Irish Channel on Monday morning, her helm was put over seventeen degrees, and the ship turned through the complete circle in eighteen minutes. Through a deficiency of power in the steering apparatus, or rather in consequence of that apparatus not yet affording convenience for the application of sufficient power to it, the helm cannot at present be got hard over at full speed. The employment of a third steering wheel with the barrel prolonged to receive it will obviate this difficulty; and when this has been done, and the helm is capable of being put hard over at full speed, she will, of course, turn in much less time.

We were not able before leaving the ship to obtain unquestionable and detailed data respecting the consumption of fuel, &c., which we the less regret for reasons before stated. We may say, however, that the consumption of coal was said to have averaged from ninety to 100 tons per day in the paddle-engine boilers, and proportionately (to horse-power) in the screw-engine boilers, the average steam pressure being about eighteen pounds. The coal burnt was Hickson's Merthyr. On Monday morning the superheating steam apparatus was put into action in one of the boilers, and was found to raise the temperature of the steam from 246 degrees to 286.

Such are the principal facts which the trial trip of this wonderful ship has put us in possession of. Hereafter, we may be able to afford more detailed information. But, however that may be, we have only to consider carefully what has been already stated, and to supplement that by our knowledge of the general advantages which the great ship was designed to secure, and doubtless will secure, in order to see that

* The Persia's tonnage (registered) is 3,300; her horse-power 900. The Great Eastern's tonnage is 18,915; her total horse-power 2,600.

† Published in the Supplement of the MECHANICS' MAGAZINE for February 18, 1859.

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in the Great Eastern her proprietors possess the most promising vessel in the world.

On another page will be found a detailed statement of the working of the paddle engines, with which we have been favoured the last thing before going to press.

STEAM-SHIP ECONOMY.

In another portion of our impression for this week will be found a paper read by Mr. Charles Atherton, Chief Engineer at Her Majesty's Dockyard, Woolwich, at the last meeting of the British Association, on "Mercantile Steam "Transport Economy as affected by the Con- "sumption of Fuel." At the same meeting was presented a Report by the Committee appointed at the Leeds meeting, "On the best mode of "recording facts of performances of vessels at "sea under all circumstances." These and an interesting paper by Admiral Paris, of the Imperial French Navy, constituted the cream of the proceedings of section G at Aberdeen. And there cannot be a doubt that they all have reference to questions of the most interesting and important character that can be made the subject of discussion in a mercantile country. Our readers will remember that this is by no means the first time we have stepped forth into the arena to address ourselves to these and kindred subjects. It most unfortunately happened that our business formerly was to disembarrass the real questions at issue from the deadly embrace of crude and unsound theories of political economy in which they were tightly held. Mr. Atherton had, in fact, contrived to bring these questions before the British public in such a manner as to render their free and temperate discussion almost a matter of impossibility. Now, happily, the selfishness of the shipping interests, and frantic invocations of the Government and Parliament to take the shipowners' concerns under their paternal care, are no longer the order of the day; and the whole question of steam-ship performance is brought down to the sober, but perhaps less exciting region of calm philosophic inquiry, from which they had unfortunately soared on the back of Mr. Atherton's winged imagination. We congratulate that gentleman on the change that has passed over the spirit of his dream; and as our objections to his lucubrations have never been of a personal nature, but prompted by our anxiety that the interests of science should not be sacrificed by a false alliance, we willingly hail him as a friend while he consents to tread with us within the charmed circle of truthful and passionless inquiry.

To do the Committee of the British Association justice, they seem from the commencement to have recognised and adhered to the proper sphere of their action. Their first object, and a most important one truly, was to obtain experimental data of such a nature as should appear likely to promote improvement in the construction and performances of steam-vessels. Their action has been chiefly taken with a view to carry out this laudable design. They have applied to various quarters—the Admiralty among others—for information, suggesting a new form of return for trial performances, which they considered more complete than that now in use. Finding, by an examination of logs communicated to them, that the particulars given in them were very incomplete, they have drawn up another form of log which they propose for sea service, in which it seems they received very material service from Admiral Paris, whose valuable services as a corresponding member they early obtained. All this is so rational that, were it not for the somewhat different course adopted by a former committee, we should think it unnecessary to make special notice of it. The Chairman of the Committee, Admiral Moorsom, has long been connected officially with the Chester and Holyhead Railway Company, whose boats perform the passenger service between Holyhead and Kingston; and he seems to have taken great pains to arrive at the best mode of ascertaining the performance of these vessels, and of securing due economy in their management. The most important and valuable returns are, as might naturally be expected, from this source, and are a tolerable indication of the nature of the information which the Committee have thought valuable. Economy and efficiency being the great objects aimed at in the management of these vessels, it may not be uninteresting to lay before our readers the details of these returns at some length. They consist of, 1, a return of the performances of the Chester and Holyhead Company's steam-vessels, *under a trial for a standard test.* 2. Return of the speed and consumption of fuel of the steamboats under regulated conditions of time, pressure, and expansion, for prior periods (1848 to 1850). 3. Return of the speed and consumption of coal of the *express* and *cargo* boats, under regulated conditions of time, pressure, and expansion, from January 31st, 1857, to December 31st, 1858. 4. Verification of consumption of coal from January 1st, 1857, to December 31st, 1858, to the introduction of a similar system into their own management. It is clear from what we have said that this Committee of the British Association has been doing good service, having been content to confine its operations to the business directly entrusted to it, and resisting the temptations to soar into more inviting but forbidden regions.

The contribution of Mr. Atherton is directed to ringing all the changes that can be got out of the combinations of the two formulæ

$$C = \frac{V^3 D^{\frac{2}{3}}}{\text{ind. h.p.}} \text{ and } C^1 = \frac{V^3 D^{\frac{2}{3}}}{w}$$

in which C and C^1 are constants, V is the speed of the vessels in knots per hour, D is the displacement, and w is the weight of coal consumed per hour in cwts. We may state in a very few words the main objects which Mr. Atherton seeks in this paper. Assuming the consumption of coal to be 2½ lbs. per indicated horse-power per hour—which has been attained in a good model, but is considerably below what is usually attained in practice—assuming also the constant C from the formula

$$C = \frac{V^3 D^{\frac{2}{3}}}{\text{ind. h.p.}}$$

to be 250, also deduced from a high type, he calculates the consumption of coal at 10 knots per hour for vessels of various sizes and horse-power from 250 tons displacement and 150 indicated, or 52 nominal horse-power, to 25,000 tons and 3,420 indicated, or 1,129 nominal horse-power. As in the performance of a voyage of definite length the consumption of coals varies as the square of the velocity, it is easy to reduce the consumption for any speed actually attained to that which it would be for 10 knots. The table constructed on this principle enables the persons interested to estimate the greater or less efficiency of any particular vessel by comparing the actual consumption of coals with what it ought to be according to this table—the efficiency, of course, being the greater for the less consumption, and *vice versâ*.

Again, he constructs another table, assuming the same data for consumption of coals and index of dynamic performance, for vessels of various displacements, ranging from 1,000 to 25,000, and for the various speeds of 10, 15, 20, and 25 knots; the object now being to guide a constructor, presuming him to choose a type not inferior to the best, in adapting the size, horse-power, and fuel in any vessel, for the service required to be performed of her.

Now, to all this we can cordially express our assent, and acknowledge that Mr. Atherton is doing good service by bringing home to the understanding of every one, and enabling him, as it were, to place his fingers upon what any purchaser of steam-power applied to marine locomotion may fairly and reasonably expect to obtain for his money, "being *based on data* "*within the limits of actually realised results.*" There are doubtless certain anomalies presented by most steam-ships to which these formulæ have been applied to which we shall not now advert; but making due allowance for all these, we cannot but think that much will be gained towards mercantile transport economy—the efficient performance of any specified service at the minimum of cost and of wear and tear—by the diffusion of such knowledge as Mr. Atherton in this paper brings prominently forward.

The insufficiency, or rather gross inaccuracy and worthlessness of the present mode of estimating nominal horse-power, and the importance of some efficient mode of valuing the actual performance of a steam-ship, have not been confined to this side of the Channel. Admiral Paris, who has been mentioned several times in the course of our present notice, is the author of a pamphlet entitled, "Utilisation Econo- "mique des Navires a Vapeur," published in the course of last year at Paris. We can do little more than offer a mere outline of his remarks. The first half of his paper is devoted to the demolition of the present mode of valuing nominal horse-power, and proposing another in its place. From him we learn that there are seven different methods of calculating the nominal horse-power in the French navy—the main principle, however, being the same in all. From the number of cylinders, the diameter and length of strokes and number of strokes of the piston of each cylinder, it is easy to calculate the volume of steam used per minute or per second (the French, it appears, very frequently take the second for the unit of time, while we *always* employ the minute); to obtain the power there now only remains the element of steam pressure on the piston, which is always assumed both here and in France to be that given by Watt for the purpose of obtaining the nominal horse-power. Moreover, the number of strokes assumed in this calculation is also borrowed from the actual use of the early engines, and all marine engines work up to a power varying from three to four times that corresponding to the number obtained by such a process. The most important element of power is entirely omitted in this calculation, viz., the boiler with its heating surface and capability for production of steam. There can be no difficulty, then, in showing that all calculations based on this principle are delusive. The only question then is, what measure is to be substituted for this defective measure. In our country, by tacit consent, horse-power, as shown by the indicator—calculated, that is, from indicator diagrams—has practically superseded the nominal power. All theoretical tests of efficiency are referred to the indicated horse-power, it being assumed that in all well-constructed engines the loss of power through friction of the several parts of the engine, &c., falls within a certain per-centage varying within narrow limits, and that the work delivered at the working parts may be taken as bearing a fixed ratio to the whole work as shown by the indicator. To this, however, Admiral Paris demurs; he thinks the indicator too small and uncertain an instrument to place entire dependence on for so important a purpose. A little disorder in the spring would involve a considerable error in the calculated power; and

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even were the working of the machine perfect, a very small error in the *reading* of the instrument would, in his judgment, introduce an error in the result too considerable to be overlooked. He proposes, therefore, to substitute for the indicator the mean pressure of the steam in the boiler, subject to certain conditions which we cannot now more particularly advert to. In the greater part of vessels he asserts that the *mean* pressure on the piston may be assumed to be one-half of the pressure in the boiler; and on this supposition a very ready and easy mode of calculating the horse-power is supplied. In any case, however, he proposes that the actual ratio of the pressure in the cylinder to that in the boiler may be tested by means of the indicator, and the indication of the horse-power thus rendered more reliable. He acknowledges that by making such an use of the indicator, viz., to obtain the ratio between the pressures, we seem to depend on the indicator almost, if not quite as much as when the power is calculated from the indicator alone, but he is of opinion that by using it only for the purpose of comparison we eliminate the greatest defects of the instrument. For our part, we are inclined to think that the two modes come pretty much to the same thing, and that the indicated power obtained as usual among us would not differ materially from the power calculated as proposed by Admiral Paris.

As, however, it is actual power which the purchaser of engines ought to pay for, it is agreed on both sides of the Channel that nominal power is no measure of what is the object of barter. Although, therefore, it is usual to pay for engines at the rate of so much per nominal horse-power, other conditions as to the actual working power of the engines are introduced into contracts which virtually set aside the nominal power as a measure of power to be obtained. We cannot see why the term and measure of nominal power should not be entirely discarded, and, instead, that the dimensions, &c., of the cylinders and pistons, and the dimensions of the boilers, including the area of fire-grates, &c., and the pressure at which the steam is to be generated, together with the indicated horse power to be developed under certain conditions, should not be the basis of the contract.

The second portion of the Admiral's pamphlet is very interesting, elucidating his "mode of "appreciating the services rendered by the "combustible, according to the magnitude of "vessels." As captain of a steamer in the Imperial Navy, his attention seems to have been directed to the importance of discovering how to turn the power to the best service; and in this respect he approached the question from the same point of view as Admiral Moorsom. He was aware of the theoretical labours of M.M. Bourgois and Moll, and availed himself of them so far as suited his purpose. The formula on which he finally takes his stand is

$$C = \frac{V^3 D^{\frac{2}{3}}}{w},$$

when w is the weight of coal consumed. In France, in place of $\frac{2}{3}$rds power of displacement, the area of midship section is generally employed. He gives at length his reasons for employing the former. Theory shows that the resistance is proportional to the midship section, which is a quantity of two dimensions. But, as in the comparison of different vessels the power of carrying cargo, which is measured by the displacement, is an important element, and as the displacement is a quantity of three dimensions, he adopts (Displacement)$^{\frac{2}{3}}$. We think, on the whole, the reasoning and the conclusion sound.

He introduces in his comparison an element, which is quite new to the English engineer, viz., the main breadth of the vessel. He seems to have been led to adopt this because the line in his plan corresponding to the theoretical "utilisation" divided by the main breadth is nearly a vertical line, and offers some advantages as a kind of base line to which to refer the other lines which result from his treatment of his formula. The results he arrives at are not materially different from those with which our readers are familiar. The advantages of size in steam vessels are fully recognised, and amongst other remarks we are much struck with one which bears a close resemblance to one hazarded by ourselves some time ago in the pages of the MECHANICS' MAGAZINE, viz., that there is probably some definite velocity which is, as it were, natural to each vessel, up to which it works easily and beyond which it cannot be pushed without sacrifice of power. He enters somewhat at length into this speculation, and estimates the probable *natural speed* of the Great Eastern at about 20 or 21 knots per hour.

Neither our design nor our limits will permit us to discuss M. Paris's conclusions at more length. Our object has been mainly to show in what position the question of steam-ship economy now stands, and what progress has been made in establishing it on a sound basis. Enough has, we think, been said to illustrate the vast importance of the subject which is attracting attention in all directions, and to give hopes that the labours of the Committee of the British Association may conduce to valuable results, by interesting persons connected with the mercantile steam-marine in the subject, directing their attention to the proper objects of inquiry and observation, and at the same time, by showing how much their pecuniary success is involved in these inquiries, stimulating their zeal without alarming their fears by a threatened interference of the Legislature in their affairs, or wounding their pride by unnecessary and unwarrantable imputations of dishonesty and selfishness.

ANCIENT MODES OF COINING MONEY IN ENGLAND.

SINCE in our pages not long since an accurate and minute account of the process of coining as practiced at present in this country has been given, it may not be wrong to give through the same channel some information as to the ancient mode of money making. The usual gradations which almost all branches of manufacture in England have passed through in their advancement towards perfection are quite traceable in the manufacture of money. Originally the heaviest operations in connection with the coinage were performed by manual labour; afterwards by the power of water, or of horses, and finally by the irresistible force of steam. To inquire into and explain the oldest system of coining, and to note the "gradual steps and slow" by which the newest improvement in the art was attained, will now be our task.

From the earliest records extant in the kingdom bearing upon the subject, we gain some curious information touching the methods of coining pursued in the infancy of our existence as a civilised nation; but there is an amount of vagueness about these documents which was evidently intended by the writers to hedge in the subject by difficulty and doubt. It is plain, however, from their moth-eaten and musty testimony—rendered from their niches in the State Paper Office, and in the British Museum—that in the early Saxon and Norman times there were a variety of small Mints established in various parts of the country, and in some cases two or three in the same city or town. These petty places for the manufacture of current coin were either under the direct supervision of the king, of some favourite prelate, or of a subject whom his majesty delighted to honour. Each of these, too, was managed and governed by a single Master or Minter, responsible for the character of the coins produced, and guaranteeing their genuineness by stamping upon each piece the initials of his name.

It is evident, that although the operation of money-making in those primitive days was one of the most simple that could be conceived—as we should think—yet that a great amount of secrecy was observed by all concerned in carrying it on. Frequently in the old parchments before-named, the term "mystery of the Mint" occurs in connection with it, and there palpably existed in the minds both of legislators and minters a wholesome and profound horror of counterfeit coiners and "smashers." In each of the kingdoms of the Saxon Heptarchy there was established at least one of these mints; and from written evidence, confirmed most completely by that borne on the faces of coins yet happily preserved, it is evident that the mechanical appliances of those establishments were of the most limited number and rudest character. In fact, it is not going beyond the truth to say that there exist in England at this hour numerous private mints for the manipulation of counterfeits, whose general fitments are not dissimilar to the Royal mints of the ancient kingdoms of the Saxon Heptarchy! and which have the advantage of superior artists and better workmen to assist their proprietors.

The earliest specimens of coins of English manufacture were palpably the direct produce of the melting pot and the mould. Clay or chalk moulds, with the device intended to ornament the money, cut in *intaglio* upon them, were prepared. Then a cylindrical vessel in which charcoal might be used as fuel, and forming a miniature smelting furnace, was provided, and these with a few infusible "pipkins" for crucibles to hold the metals, a pair or two of tongs, a file, or cutting tool of some kind, and scales for weighment of the monies, constituted unquestionably all the machinery of each of their Majesties' mints of the year 900! The well-known "man and a boy" would have been an almost competent staff for working one of these little "money-making concerns;" at any rate two men and a boy would have been ample. In those days of limited—very limited—cash payments, and when competition among small traders was very small, the number of coins thus produced in ten hours would be doubtless sufficient for the diurnal requirements made upon each mint. It is thought likely that in the time of Athelstan this melting and pouring system was superseded by another, which if it had not involved the use of engraved metallic tools, or dies, would have been nearly as simple. The melted bullion was now poured through a sieve—as in the modern plan of casting small shot—and the resulting globules of metal—some of which in the form of flattened hemispheres still exist—having been placed on a stone and struck by a stamp with force of hammer, then received a blow that, serving to flatten and to impress their upper sides with the device engraved on the die, prepared them also for the active duties of circulation. Although the use of iron or steel stamps incident to this latter arrangement occasioned the employment additionally of a blacksmith and die engraver, yet the personal establishment required to carry it on practically remained as limited as in the "pot and mould" system.

The "hammer and die" method of coining existed for a considerable time, and the coins resulting from it exhibit a sharpness of finish which neither the coiners of the Heptarchy a thousand years since nor those of Whitechapel or Birmingham of to-day are able to produce on *cast* pieces of money. In the museum of the Tower-hill Mint there are, as we are informed, preserved several of the blacksmith-like tools or dies which were used in the process last referred to, and even collars of lead with which the workmen held them whilst being struck, in order to prevent the jarring caused by the blow from being transmitted to their own muscular systems. This mode of coining, however, was attended with several draw-

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backs, and the march of improvement, then a very slow march, caused at length its abandonment. The frequently-recurring series of meltings required, attended as they were by expense and loss of time, was one of the most serious of these drawbacks. It is unfortunate that the names of the ingenious individuals who suggested and perfected, no doubt after much thought and experimentation, the plan which immediately succeeded the globule system, are lost in the mists of antiquity. But that plan is worthy of especial note. Cylindrical ingots were cast of considerable length and of the exact diameters of the coins to be produced; and these when cut transversely yielded, of course, discs of metal of nearly the proper thickness. The file and scales were the means of bringing them to the exact weight required, and nothing remained but to place them one by one upon an engraved die, and then administer to another die held carefully upon the piece a sharp blow with a hammer. This system is employed, we believe, at some of the Indian mints—those not under British control—up to this hour, and it cannot be denied that it is not a bad system. Indeed, with the mechanical appliances which might now be brought to bear in carrying out such an arrangement, it is by no means certain that it might not be economically and effectively carried on at home. It does not seem an irrational idea to cast bars of metal, in well-finished cylindrical moulds, —of steel or even of cast iron—of the precise diameter of each denomination of coin, and then by the rapid action of machines to cut, in the fashion of a cucumber slicer, discs of metal of the proper thickness to give each a proper weight. The melting pot would thus perform a principal part of the operation of coining, and the rolling mills would be dispensed with entirely! As it is, in most mints, rectangular bars are cast, and these have to be elongated by lamination, brought by gauge to the right thickness, and then perforated by circular punches of the sizes of the various coins. Necessarily a great proportion, it is said nearly half—and it must be so—of the metal issued from the melting department must by this mode go back to it for reconversion into new bars. By the cylindrical process it is clear that a very small portion of a batch of well-cast bars would require remelting. The moulds might, in the present advanced state of mechanical science, be made as smooth within as the inside of a musket barrel, and thus perfectly "clean" castings would be obtained from them, whilst the slicing machines would at once feed the bars forward and shear them off in blanks of the thickness for florins, shillings, or any other coin, and which the stamping presses would finish most rapidly for issue. But without pursuing this digression further, we return to the history of the rise and progress of coining.

From the Red Book of the Exchequer, quoted by Leake and referred to by Ruding, it appears that the new money struck in the eighteenth year of the reign of Edward I. was made in the following manner:—First, the metal was cast from the melting-pot into long rectangular bars; these bars were cut by shears into square pieces of exact weights; then with tongs and hammer they were forged into round shape; after which they were blanched, that is, made clean and soft by annealing and boiling in acid, and then stamped or impressed by being placed as described between dies, and thus made current coin. The advantage of this change is not very apparent, for it involves a great deal of additional labour, without any proportionate advantage. But at any rate the plan appeared to have remained in force until the year 1561. Queen Mary, however, caused an important change to be made, prior to that date—about 1546, indeed—as regarded the localities in which minting was carried on. Her popish majesty consolidated the Royal mints of the kingdom under one roof, and the provincial mints, as a matter of course, were all closed. In the Tower of London all the monies produced in her reign were coined.

The year 1561 was the epoch of a remarkable improvement in the mode of manipulating money. A Frenchman then introduced the "mill and screw" for the first time in the English mint. This system was found to work well, but it is sad to state that the French inventor who was the means of its introduction was hanged at Tyburn for counterfeiting! Not satisfied with the means of making money for the Government, he established a private mint, and was accordingly made a public example of at that terrible place of retribution. Whether the use of his machinery was ever entirely discontinued does not clearly appear, but it is quite certain, from the evidence of coin subsequently struck, and some of which is still extant, that up to the middle of the next century the hammer was used for getting up impressions. In 1629 a Royal warrant was issued authorising Nicholas Briot, the eminent engraver to the mint at that time, to make trial in the Tower of his new method of coining money by mills and presses; but from certain impediments put in his way by the executive officers of the place this trial was set aside. In 1649 "the Council of State and Commons in Parliament" having had it represented to them that the coins of the Government might be more perfectly and beautifully done, the Council of State therefore ordained, on the 8th of August, to send for Peter Blondeau from Paris to come to London to treat with them upon the price and expense of coining money after his new invention. He accordingly arrived in town on the 3rd of September following, but though a committee of the Mint was appointed to examine into his new way of coining, and a very favourable report was made respecting it, yet so powerful was the opposition of certain "moneyers," who appear to have somehow had a vested interest in keeping things as they were, that a very considerable time elapsed before a trial of it was made. Blondeau at last nevertheless succeeded in executing some proof-pieces, but his enemies produced against them other proof pieces, and instituted into the bargain a prosecution against the French machinist for *coining money in a private house*. Their continued opposition at length drove Blondeau back to Paris.

Before finally passing from this period it may be said that from the excellence of the engraving of Briot and Simon, it developed very great beauty and perfection in the coinage. Indeed, notwithstanding the more recent employment of comparatively magnificent machinery to any then in use, with elaborate arrangements, appliances of every kind, and notwithstanding the increase of salaries to officers of the Mint, amounting in the aggregate to £10,000 or £12,000, against a total then paid of £650, still scarcely an approach has since been made to the excellence of the coins they executed. When it is taken into account, also, that the inferiority of the coinage, as regards execution, is the main source of the facility of counterfeiting, and of the correlative heavy law expenses of prosecuting offenders of the coin laws, that becomes rather an important admission. From the time of Simon, the engraver, it is certain the coinage has of the two degenerated. In the time of William III. this fact was publicly announced, for in a State document of his reign we read that "our present money is so disingeniously coined, that it may be easily debased, diminished, and counterfeited."

In 1662 Blondeau triumphed over the banded opposition which had caused his disappearance from the country, and agreements were entered into with him to "furnish all the mills, rollers, presses, &c., &c., necessary, and to instruct the moneyers in the use of his newly-invented tools and engines." The moneyers were bound to pass the plates of gold or silver through the *horse* mill, and to cut, flatten, size, neale, blanch, and coin the pieces; *to maintain the horses*, to find alum, argot, and sawdust, to keep in repair the ovens, furnaces, and utensils for nealing and blanching; to make good the balances, small files, tubs, trays, bowls, and sacks, and all waste of gold and silver in nealing, blanching, and working. This was, therefore, the *horse* stage in the history of the coinage. With certain modifications of details the principles of Blondeau's plans of coining were successfully acted upon until the introduction in 1810 of Boulton and Watt's powerful steam machinery, which, with sundry additions, is now employed on Tower-hill for the manipulation of coins, and has been heretofore described by us.

It appears that from the very earliest period of the annals of coining in this country counterfeiters have successfully plied their craft; but it seems that about 1560-61 the crime was at its height. At that time a great re-coinage took place, and it is on record that of 631,950 pounds of money then re-coined only 244,416 pounds of "fine monies" could be produced, whilst the dross of this mass of metals was "carried to foul highways" and places where rubbish might be shot. In fact, the bulk of waste in this re-coinage must have been considerable, as the difference of weight after the metal had been reduced to standard was 387,534 pounds. A strange story is told, too, of the workmen engaged in melting down the base coins; "most of them," it is said, "fell sick to death with the savour, and were advised to drink in a dead man's skull for their cure, and, accordingly, a warrant was procured from the Council *to take off the heads from London-bridge* and to make cups of them, out of which they drunk and found some relief, (?) although most of them died." It is probable that the sickness arose from their inhalation of the fumes of arsenic with which the base metal was mixed, but it is very questionable whether the medical prescription was a good one.

There are other interesting particulars in connection with the progress of minting, and it is not unlikely that at an early opportunity we may recur to the subject.

STEAM SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I beg to forward herewith a copy of the paper presented by me to the British Association at their late meeting at Aberdeen, in continuation of my former papers on "Mercantile Steam Transport Economy." The public import of this paper will, I hope, induce you to give it the extensive publicity which is afforded by the MECHANICS' MAGAZINE. I have endeavoured to make the papers explicit, but as the study of such subjects requires considerable time and attention, it may not be amiss that I somewhat prepare your readers for it with the remark, that the object of the paper is to popularise some method of determining the relative dynamic merits of steamers as implements of transport, by comparing the coal duty actually performed by them with the coal duty capable of being performed by ships of a certain definite scale of efficiency taken as a standard of comparison. If one steam-ship be inferior to another as respects its capability for performing transport duty, that is, the ratio of work performed to coals consumed, there must be some cause, or combination of causes, for such difference; but the fact of inferiority being established, the cause will be inquired into, and it will soon be ascertained whether the fault lie in the condition or type of form of the hull, or with the condition, construction, or management of the boilers and machinery. It is evident that however excellent the type of form of a ship may be, a foul bottom will (*cæteris paribus*) detract from its speed; the best coals may be consumed by badly stoked or badly constructed boilers without producing their due amount of steam, and from the bad adaptation or bad management of engines, an undue proportion of the indicated power may be non-effective. Abuse in any one of these points will tell its tale when the coal duty of a steam-ship comes to be compared with that of a standard type; under such a system of comparison one ship with another, it may be expected that steam

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shipping improvement, as respects construction and management, will be gradually advanced, and, consequently, that mercantile steam transport economy will be gradually promoted, to the benefit of public interests. I am, Gentlemen,

Your very obedient servant,

CHARLES ATHERTON.

Woolwich Dockyard, 6th Sept., 1859.

MERCANTILE STEAM TRANSPORT ECONOMY AS AFFECTED BY THE CONSUMPTION OF FUEL.

By CHARLES ATHERTON, Chief Engineer, Royal Dockyard, Woolwich.

Public usefulness, as dependent upon science, being the great object for which the "British Association for the Advancement of Science" was originated, and has now been signally upheld for 29 years, a period remarkable for the progress that has been made in the utilisation of the powers of nature to such extent that the international condition of the globe is now being revolutionised by the progressive practical utilisation of elements which heretofore were regarded merely as phenomena of nature, viz., steam and electricity; in which revolution the application of steam to the purposes of navigation has played so conspicuous a part, that now, in proportion as steam may be effectively employed in the pursuits of commerce and of war, it is acknowledged that even nations will rise and fall. Seeing, moreover, that at no period in the history of steam navigation has so great a step been made in its practical development as may now be said to have been realized by the fearless introduction, in marine engineering, of the long-known and well-understood effects of increased pressure, superheating, and expansion; the recognition and application of which principles has now, at length, been attended with such effect in marine engineering, that the consumption of fuel with reference to power is now shown to be practically reduceable to less than one-half of the ordinary consumption on board ship. Seeing, also, that mercantile enterprise, setting no limits to speculative investments, has in these days emancipated mechanical intellect from the fetters by which ideas as respects magnitude have hitherto been bound. Under such circumstances I cannot doubt that any effort to popularise a knowledge of the practical utilisation of steam, with reference to the consumption of fuel, though advanced with no pretensions to science, beyond that which may be awarded to originality and labour in the application of calculations to developing useful results, will be favourably received; more especially as the paper which I now beg to present is in continuation and conclusion of an inquiry which has already, in part, on two occations, been favourably entertained by this Association, and honoured with a place in its published records. The former papers to which I allude are:—1st. "Mercantile Steam Transport Economy with reference to Speed."—Vol. for 1856. p. 423. 2nd. "Mercantile Steam Transport Economy, with reference to the Magnitude of Ships, and their Proportions of Build."—Vol. for 1857, p. 112. And I now purpose to bring this inquiry to its conclusion by the following paper on

Mercantile Steam Transport Economy, as affected by the Consumption of Coals.

My purpose, and the drift of my remarks, will, probably, be the more readily understood by my at once adducing the following tables C and D, and the diagram E, in continuation of the tables A and B, which are published in the Volume of Transactions for the year 1857, pp. 116 and 119, observing with reference to these tables C and D, that the rate of consumption of coal on which the calculations are based, viz., 2¼lbs. per indicated horse power per hour has been practically realised on continuous sea-service, although the ordinary consumption of steam-ships in the Royal Navy, as well as in the best vessels of the most celebrated steam shipping companies, is, I believe, at the present time, fully 50 per cent. in excess of that amount; and I may say, that in steam ships generally, the consumption of coals per knot of distance, with reference to displacement and speed, is double the consumption which these tables, based as they are on an example of existing practice, show to be now practically realisable.

The tables now adduced are as follows:—

Table C, calculated for the speed of 10 knots per hour, showing the mutual relations of displacement, power, and the consumption of coals *per day, per hour, and per knot*, for vessels of a gradation of sizes, from 250 tons displacement up to 25,000 tons, the co-efficient of dynamic performance, deduced from the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{ind. h.p.}}$ being assumed to be 250, and the consumption of coals being assumed to be at the rate of 2¼ lbs. per indicated h. p. per hour. On these data, the co-efficient with reference to coals deduced from the formula $\frac{V^3 D^{\frac{2}{3}}}{w}$ (w being the consumption of coals per hour expressed in cwts.) becomes 11,210.

Table D, showing the mutual relation of displacement, power, and coals consumed *per day, per hour*, and *per knot*, for the respective speeds of 10, 15, 20, and 25 knots per hour. The data on which this table is calculated being the same as above described for Table C.

Diagram E, showing approximately by scale the nautical mileage consumption of coals for vessels from 1,000 tons displacement up to 25,000 tons, deduced from Table D.

It will be observed that in Table C the tabulated sizes of ships, as determined by their respective load displacements, increase progressively from 250 tons displacement up to 25,000 tons, showing under assumed conditions, which, however, are justified by the present circumstances of realised advancement in steam navigation, the mutual relations of displacement and coals calculated for the speed of 10 knots per hour as most convenient for a standard of reference. The in-

TABLE C.

Calculated for the Speed of 10 knots per hour, and showing the mutual relations of Displacement, Power, and the Consumption of Coals, per Day, Hour, and Knot, the Co-efficient of Dynamic performance, deduced from the Formula $\frac{V^3 D^{\frac{2}{3}}}{\text{ind. h.p.}}$ being assumed to be 250, and the consumption of fuel at the rate of 2½ lbs. per ind. h.p. per hour.

Displacement.	Nominal H.P. taken at the unit 100,000 lbs. 1 ft. per min.	Indicated H.P. taken at the unit 33,000 lbs. 1 ft. per min.	Coals.		
			Per Day 24 hours.	Per Hour.	Per Knot.
Tons.	H.P.	Ind. H.P.	Tons.	Cwt.	Cwt.
250	52	159	4·26	3·55	·36
300	59	179	4·80	4·00	·40
350	66	199	5·33	4·44	·44
400	72	217	5·81	4·84	·48
450	78	235	6·30	5·25	·53
500	83	252	6·74	5·62	·56
600	94	285	7·63	6·36	·64
700	104	315	8·44	7·03	·70
800	114	345	9·24	7·70	·77
900	123	373	9·98	8·32	·83
1,000	132	400	10·70	8·92	·89
1,100	141	426	11·4	9·51	·95
1,200	149	452	12·1	10·1	1·01
1,300	157	476	12·7	10·6	1·06
1,400	165	501	13·4	11·2	1·12
1,500	173	524	14·0	11·7	1·17
1,600	181	547	14·6	12·2	1·22
1,700	188	570	15·4	12·8	1·28
1,800	195	592	15·8	13·2	1·32
1,900	203	614	16·4	13·7	1·37
2,000	210	635	17·0	14·2	1 42
2,250	227	687	18·4	15·3	1·53
2,500	243	737	19·7	16·4	1·64
2,750	259	785	21·0	17·5	1·75
3,000	275	832	22·3	18·6	1·86
3,250	290	878	23·5	19·6	1·96
3,500	304	922	24·7	20·6	2·06
3,750	318	965	25·8	21·5	2·15
4,000	333	1008	27·0	22·5	2·25
4,250	347	1050	28·1	23·4	2·34
4,500	360	1090	29·2	24·3	2·43
4,750	373	1130	30·2	25·2	2·52
5,000	386	1170	31·3	26·1	2·61
5,500	411	1246	33·4	27·8	2·78
6,000	436	1321	35·4	29·5	2·95
6,500	460	1393	37·3	31·1	3·11
7,000	483	1464	39·2	32·7	3·27
7,500	506	1533	41·0	34·2	3·42
8,000	528	1600	42·8	35·7	3·57
8,500	550	1666	44·6	37·2	3·72
9,000	571	1731	46·3	38·6	3·86
9,500	592	1794	48·0	40·0	4·80
10,000	613	1857	49·7	41·4	4·14
11,000	653	1978	52·9	44·1	4·41
12,000	692	2096	56·2	46·8	4·68
13,000	730	2211	59·2	49·3	4·93
14,000	767	2324	62·3	51·9	5·19
15,000	803	2433	65·2	54·3	5·43
20,000	973	2948	79·0	65·8	6·58
25,000	1129	3420	91·6	76·3	7·63

TABLE D.

Showing the Mutual Relations of Displacement, Power, and Coals consumed per Day, per Hour, and per Knot, for the respective Speeds of 10, 15, 20, and 25 Knots per Hour. The Co-efficient of Dynamic Performance being deduced from the Formula $\frac{V^3 D^{\frac{2}{3}}}{\text{ind. h.p.}}$ being assumed to be 250, and the Consumption of Coals being assumed to be at the rate of 2½ lbs. per indicated horse power per hour.

Displacement in Tons weight, at 35 cubic ft. of Sea Water per Ton.	10 Knots.				15 Knots.				20 Knots.				25 Knots.			
	Ind. H. P.	Coals.			Ind. H. P.	Coals.			Ind. H. P.	Coals.			Ind. H. P.	Coals.		
		Per Day.	Per Hour.	Per Knot.		Per Day.	Per Hour.	Per Knot.		Per Day.	Per Hour.	Per Knot.		Per Day.	Per Hour.	Per Knot.
		Tons.	Cwt.	Cwt.		Tons.	Cwt.	Cwt.		Tons.	Cwt.	Cwt.		Tons.	Cwt.	Cwt.
1,000	400	10·7	8·92	·89	1,350	36·1	30·1	2·0	3,200	85·7	71·4	3·57	6,250	167	139	5·56
1,200	452	12·1	10·1	1·01	1,524	40·8	34·0	2·27	3,614	96·8	80·7	4·03	7,058	188	157	6·28
1,400	501	13·4	11·2	1·12	1,689	45·2	37·7	2·51	4,005	107	89·4	4·47	7,822	210	175	7·00
1,600	547	14·6	12·2	1·22	1,847	49·4	41·2	2·75	4,377	117	97·7	4·88	8,550	229	191	7·64
1,800	592	15·8	13·2	1·32	1,998	53·5	44·6	2·98	4,735	126	105	5·25	9,248	247	206	8·24
2,000	635	17·0	14·2	1·42	2,143	57·4	47·8	3·19	5,080	136	113	5·65	9,921	265	221	8·84
2,250	687	18·4	15·3	1·53	2,318	61·8	51·5	3·43	5,495	146	122	6·10	10,731	287	239	9·56
2,500	737	19·7	16·4	1·64	2,487	66·6	55·5	3·70	5,895	158	132	6·60	11,512	308	257	10·3
2,750	785	21·0	17·5	1·75	2,650	70·9	59·1	3·94	6,281	168	140	7·00	12,268	328	273	10·9
3,000	832	22·3	18·6	1·86	2,808	75·2	62·7	4·18	6,656	178	148	7·40	13,000	348	290	11·6
3,250	878	23·5	19·6	1·96	2,962	79·3	66·1	4·40	7,021	188	157	7·85	13,715	367	306	12·2
3,500	922	24·7	20·6	2·06	3,112	83·3	69·4	4·63	7,377	197	164	8·20	14,408	385	321	12·8
3,750	965	25·8	21·5	2·15	3,259	87·2	72·7	4·85	7,724	206	172	8·60	15,086	404	337	13·5
4,000	1008	27·0	22·5	2·25	3,402	91·1	75·9	5·06	8,064	216	180	9·00	15,749	421	351	14·0
4,250	1050	28·1	23·4	2·34	3,542	94·9	79·1	5·27	8,396	224	187	9·35	16,399	439	366	14·6
4,500	1090	29·2	24·3	2·43	3,680	98·5	82·1	5·47	8,722	233	194	9·70	17,036	456	380	15·2
4,750	1130	30·2	25·2	2·52	3,815	102	85·1	5·67	9,042	242	202	10·1	17,661	473	394	15·8
5,000	1170	31·3	26·1	2·61	3,947	106	88·1	5·87	9,357	251	209	10·4	18,215	488	407	16·3
6,000	1321	35·4	29·5	2·95	4,458	120	100	6·67	10,566	283	236	11·8	20,637	553	461	18·4
7,000	1464	39·2	32·7	3·27	4,940	132	110	7·33	11,710	313	261	13·0	22,870	612	510	20·4
8,000	1600	42·8	35·7	3·57	5,400	145	121	8·01	12,800	342	285	14·2	25,000	670	558	22·3
9,000	1731	46·3	38·6	3·86	5,841	156	130	8·67	13,846	371	309	15·4	27,042	724	603	24·1
10,000	1857	49·7	41·4	4·14	6,266	167	139	9·27	14,853	398	332	16·6	29,010	778	648	25·5
12,000	2096	56·2	46·8	4·68	7,076	190	158	10·5	16,772	449	374	18·7	32,760	877	731	29·2
14,000	2324	62·3	51·9	5·19	7,842	210	175	11·7	18,588	498	415	20·7	36,305	972	810	32·4
16,000	2540	68·0	56·7	5·67	8,572	229	191	12·7	20,320	544	453	22·6	39,684	1063	886	35·4
18,000	2748	73·6	61·3	6·13	9,272	248	207	13·8	21,980	589	491	24·5	42,924	1150	958	38·3
20,000	2948	79·0	65·8	6·58	9,948	266	222	14·8	23,580	631	526	26·3	46,048	1233	1028	41·1
22,000	3140	84·0	70·0	7·00	10,600	283	236	15·7	25,124	673	561	28·0	49,072	1314	1095	43·8
25,000	3420	91·6	76·3	7·63	11,542	310	258	17·2	27,359	733	611	30·5	53,436	1432	1193	47·7

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tended practical use of this Table C is to facilitate mercantile investigation into the dynamic merits of steam-ships as locomotive implements of burden by comparing their actual consumption of fuel with the calculated consumption of the ship of corresponding size and speed as recorded in this tabulated standard of comparison, whence the constructive merit of ships, as respects their *working economy of fuel, on which the cost of freight so much depends*, may be relatively ascertained. For example, a certain ship of 800 tons mean displacement attains the speed of 8·8 knots per hour, with a consumption of coals certainly not exceeding 4·3 cwts. per hour, or ·49 cwts. per nautical mile or knot; which (as the consumption of coals per knot varies *cæteris paribus* as the square of the speed) is equivalent to ·63 cwts. per knot at the speed of 10 knots per hour. Now, by referring to Table C we find that on the assumed data therein referred to the standard ship of 800 *tons* displacement, steaming at 10 knots per hour, would consume ·77 cwts. of coal per knot. Hence, therefore, it appears that the ship referred to in this instance is *superior* to the tabulated standard in the proportion of ·77 to ·63, that is, in the proportion of 122 to 100, the superiority with reference to the consumption of coals per knot being 22 per cent.

Again, a certain ship of 3,500 tons mean sea displacement makes a voyage at the average speed of 12·88 knots per hour, consuming 83 cwts. of coal per hour, or 6·44 cwts. per knot, which, by the law of dynamics above quoted, is equivalent to 3·88 cwts. per knot at the speed of 10 knots per hour; but by referring to the Table of comparison C, we find that the standard ship of 3,500 tons displacement, steaming at 10 knots per hour, would consume only 2·06 cwts. of coal per knot. Hence, therefore, it appears that the ship referred to in this instance is *inferior* to the tabulated standard ship in the proportion of 2·06 to 3·88, that is, in the proportion of 53 to 100, the inferiority with reference to the consumption of coals being 47 per cent.

Thus, by reference to this tabulated standard of comparison (C), we have the means of readily deducing the exact per-centage by which ships, as respects the dynamic duty performed with reference to the consumption of coals, differ from each other. I need not dwell on the importance of this consideration as affecting the commercial value of ships.

With reference to Table D, showing the mutual relations of displacement, power, and coals consumed per day, per hour, and per knot for the respective speeds of 10, 15, 20, and 25 knots per hour, the object of this table is to show the extent to which the required engine-power and the nautical mileage consumption of coals are dependent on the rate of speed, thereby facilitating the adaptation of ships as respects their size and power to the service that may be required of them.

For example, by referring to Table D, we observe that a ship of 5,000 tons displacement, steaming at 10 knots per hour, requires 1,170 indicated h. p., and consumes 2·61 cwts. of coal per knot; but to steam 15 knots per hour, the same vessel would require 3,947 ind. h. p., and the consumption of coals would be 5·87 cwts. per knot; hence it appears that to increase the speed from 10 knots to 15 knots per hour, the power requires to be increased upwards of three times, and the consumption of coals per knot is more than doubled.

Again, let it be supposed that the weight of the hull of a ship of 5,000 tons displacement fitted for sea amounts to 40 per cent. of the displacement, or 2,000 tons, and suppose the weight of the engines and boilers to be one ton for each 10 indicated h. p., the vessel requiring, as shown by Table D, 1,170 indicated h. p., to attain the speed of 10 knots per hour, with a consumption of coals at the rate of 2·61 cwts. per knot, then on these data, the engines, to attain the speed of 10 knots per hour, would weigh 117 tons, and the weight of coals for a passage of, say 12,000 nautical miles, would be $12{,}000 \times 2{\cdot}61 = 31{,}320$ cwts., or 1,566 tons weight, making together for hull, engines, and coals, $2{,}000 + 117 + 1{,}566 = 3{,}683$, and consequently the displacement available for cargo would be $5{,}000 - 3{,}683 = 1{,}317$ tons weight. But if it be purposed that the steaming speed shall be at the rate of 15 knots per hour, the required power, as appears by Table D, will be 3,947 ind. h. p., consequently the weight of the engines will be 395 tons and the maximum displacement available for coals will be $5{,}000 - 2{,}395 = 2{,}605$ tons weight, or 52,100 cwt., which, at the tabulated rate of consumption, 5·87 cwts. per knot, would be sufficient only for a passage of 8,876 nautical miles, and this to the utter exclusion of all goods cargo, showing that the ship is inadequate for steaming 12,000 nautical miles at the required speed of 15 knots per hour, though the same ship, if duly fitted with engine-power for steaming at 10 knots per hour, would perform the whole passage of 12,000 nautical miles without recoaling at any intermediate station, and carry 1,317 tons of remunerating goods cargo.

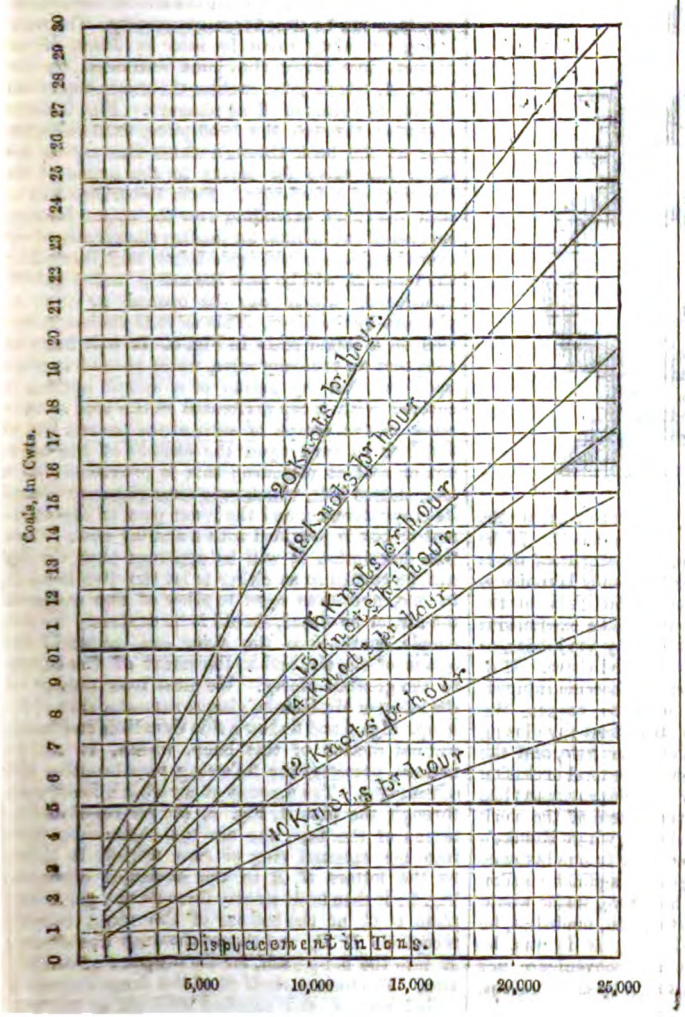
These few examples will, it is hoped, sufficiently illustrate the application and use of Tables C and D in facilitating mercantile inquiry into the capabilities of steam-ships with reference to the all-important question of consumption of coals; but in order still further to facilitate calculations on this subject, the Diagram E has been prepared, whence, simply by inspection, the consumption of coals per knot, at any rate of speed, may be approximately ascertained for vessels from 1,000 tons displacement up to 25,000 tons, the data on which this diagram has been calculated being the same as that on which Tables C and D are based.

The use and application of this Diagram E is evident; it brings the tables under occular review, and generalises their application. It is given as an example of a system that admits of being more fully and elaborately developed for the purposes of mercantile tabular reference, as is now being done for publication.

Having thus explained the use and application of Tables C and D and the Diagram E, it will be perceived that the task which I have undertaken on this occasion is to show palpably by comparison with these tabular statements, *based on data within the limits of already realised results*, taken as a standard, what is the character of steam-ships as respects their locomotive or dynamic capabilities, with reference to the economic performance of mercantile transport service, so far as dependent on the consumption of fuel, thus affording an exposition whereby parties interested in steam shipping, either as owners or directors, or agents, or as the charterers of shipping for Government or for private service, though unacquainted with the details of marine engineering as a science, may be enabled to arrive at some definite appreciation of the amount of work that may be expected of steamers; that is, the weight of cargo they will carry, and the length of passage capable of being performed at any definite speed, for, as before observed, the dead weight of cargo that a ship will carry is equal to the tons' weight of water displaced between the light and load water-lines of the ship, less the weight of coals required for the voyage, and which for long voyages commonly amounts to four times the weight of cargo chargeable as freight, and it constitutes the limitation of distance which the ship is able to run under steam at a given speed. This inquiry is therefore essential to a due appreciation of the economic consequences which are involved in progressive variations of steam-ship speed, especially as respects the high rates of speed, which are occasionally professed, but which are seldom realised, simply because there has been no recognised exposition whereby such pretensions may be judged of with reference to the required consumption of fuel. In short, regarding this matter as a public cause, affecting as it does the pecuniary interest of the public to the extent of millions sterling per annum, my object is to promulgate, through the medium of the notoriety which every inquiry obtains upon its being brought before the notice of the "British Association for the Advancement of Science," a Mercantile Steam-Ship Expositor, by reference to which as a standard of comparison the good or bad qualities of steam shipping may be determined; and this surely

E.

Diagram showing approximately the Nautical Mileage Consumption of Fuel, for Vessels from 1,000 tons displacement, up to 25,000 tons, the Co-efficients of Dynamic Performance deduced from the Formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h. p.}}$ being assumed to be 250, and the Consumption of Coals being assumed to be at the rate of 2½ lbs. per Ind. H. P. per hour.



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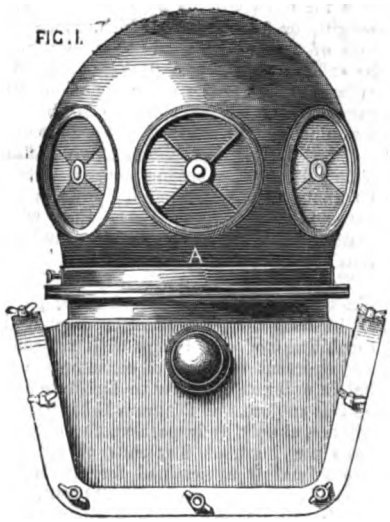
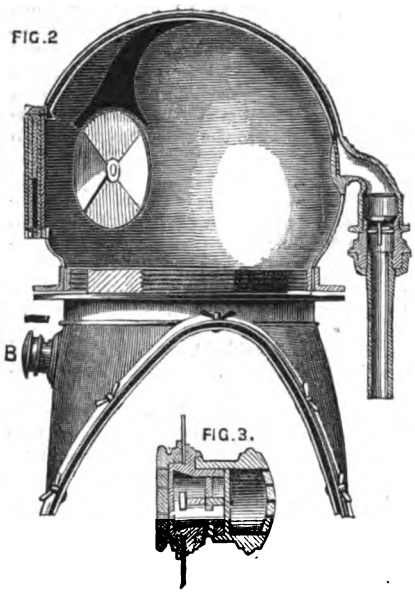
HEINKE'S PATENT DIVING APPARATUS.





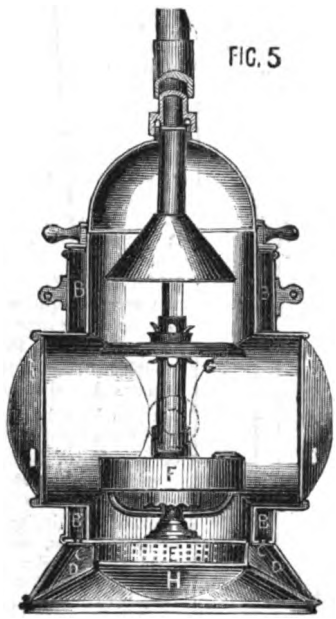
is a public cause, for by the operation of the scrutiny which such a system of comparative exposition may be expected to inaugurate and popularise, steamers will soon become *marketable, with reference, in great measure, to their capabilities for economic transport service*, according to the speed that may be required; and under the influence of this scrutiny all bad types of form and vicious adaptation of mechanical system, will be eradicated; incompetency in steam-ship management will become gradually eliminated, and the mercantile transport service of the country being then performed exclusively by good, well-appointed, and well-managed ships, would be performed at a *minimum* of cost to the shipping interests, and consequently to the *best advantage* for the interests of the public. Hitherto the dynamic character of steam-ships has been a mechanical problem enveloped in undefined and even delusive terms of shipping and engineering art; consequently, its determination has not been based on any recognised principles of calculation. Hence the dynamical character of shipping has been a mystery—a matter of mere assertion on the one hand, and of credulity on the other. But mystery being unveiled, commercial vision will be opened, and competition, in shipping as in any other well-understood and open field of public enterprise, will insure the mercantile transport service of the country being performed to the best advantage, and it will gradually establish and preserve the just equilibrium of trade as between the carriers and consumers of all the sea-borne productions of the earth.

CHAS. ATHERTON.

Woolwich Dockyard, 1st Sept., 1859.

HEINKE'S PATENT SUBMARINE DIVING APPARATUS.

A SAFE and efficient apparatus to enable operations to be conducted under water has long been considered a very important and desirable object of attainment. Mr. Heinke, who is well known as an engineer who has spent the best part of his time of late years in submarine operations, has recently patented a new apparatus which combines so many improvements that we have much pleasure in introducing it to our readers. It consists of a diving helmet, which is attached to a waterproof dress, and a submarine lamp, which forms a most useful adjunct. We will first describe the helmet. Upon the breast-plate of this helmet, and in front of the diver, is placed a safety valve, so as to be easy of access, which at any moment he



can close partially or wholly, so as to regulate the egress of the air fed down from above. If he shuts this valve completely, his waterproof dress is at once inflated, and his buoyancy becomes so great that without any effort he rises to the surface like a cork, in a much more expeditious manner than he could climb up by the ladder, or even be drawn up by those stationed above. If at any time part of his dress should become injured, or the glasses before his eyes be broken, the opening thus formed can in an instant (by closing the valve) be turned into the egress hole, and the air made to take that course, to the total exclusion of the water. The value of this improvement has been well exemplified in the course of the work upon the new Westminster Bridge, where Heinke's apparatus is exclusively used; for in one instance a diver struck one of his glasses against a spike, and if he had not closed his valve, water would instantly have been admitted, and, doubtless, he would have been drowned; but, as it was, he turned the valve, and felt no inconvenience, nor were his clothes even moistened by the accident. We subjoin a woodcut showing a section and elevation of one of Heinke's helmets, as also a sectional view of the valve. Fig. 1 shows a front elevation of the helmet itself. It will be seen from this that the openings are also provided (as an extra safety-guard) with segmental plates, so that by turning either disc round by means of the buttons which project from the circumference, the openings can be closed instantaneously. The regulating or safety valve is seen in front of the helmet, just below the joint indicated by the letter *A*, which joint enables the whole top of the helmet to be taken off at pleasure. Fig. 2 shows a section through the head-piece, exhibiting the pipe at the back through which the air is fed down the valve for safety in the event of the bursting of a feed-pipe. From the orifice will be seen the tubes, extending over the upper internal surface of the helmet, for leading the stream of air over the glasses; and again below, and marked by the letter *B*, will be seen the safety valve before-mentioned, which can be opened or shut at pleasure by the diver. This valve is shown in section on a larger scale in Fig. 3. It will there be seen that an ordinary valve, which is held in place upon its seat by means of a spiral spring, is covered with a cap perforated on the top, so as to allow of the escape of such air as passes, but so fitted as to turn upon the outside of the valve-box or seat at pleasure; this is provided with a long slotted hole, which runs some distance around its circumference, and the lower part of the valve-seat or box is provided with a similar slot. From this description it will be apparent that the cap can be turned so as either to let the two holes be in one, and thus open to allow of the escape of the air, or be closed, should it be desired; by this simple contrivance the diver can regulate the egress of the air, and so the extent of the supply to the greatest nicety. We must now pass on to the latest of Mr. Heinke's improvements, that of his lamp. Figs. 4 and 5 show a side elevation and longitudinal section of this lamp, which, it will be noticed, possesses the following peculiarities and advantages. The amount of air which is supplied through the pipe *A*, Fig. 4, can be regulated by means of the tap; the air thus admitted flows into the external ring or case, which is shown by the letters *B B* in the sectional elevation, Fig. 5; it then finds its way through the perforated plate *C C*, at the bottom of the ring, into the receptacle *D D*, and thence through the strainer *E* into the lamp itself, for the support of combustion. The burner itself is of the form commonly called argand, and supplied with oil or gas fro u

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the ring *F*, which is made open, so as to allow of the light from the lamp being thrown down from the reflector *G*, through the lense *H*, so that by this means the bottom surface of the sea can be examined without removing the lamp from its upright position. The lamp is also provided with two side lenses *I I*; or three can be used if required. The upper cap is fitted with an internal cone, which is connected with a pipe leading to the surface of the water for the escape of the products of combustion. This lamp gives a brilliant light, and the air supplied percolating through the lower ring enables it to burn steadily, a matter of considerable importance in such cases.

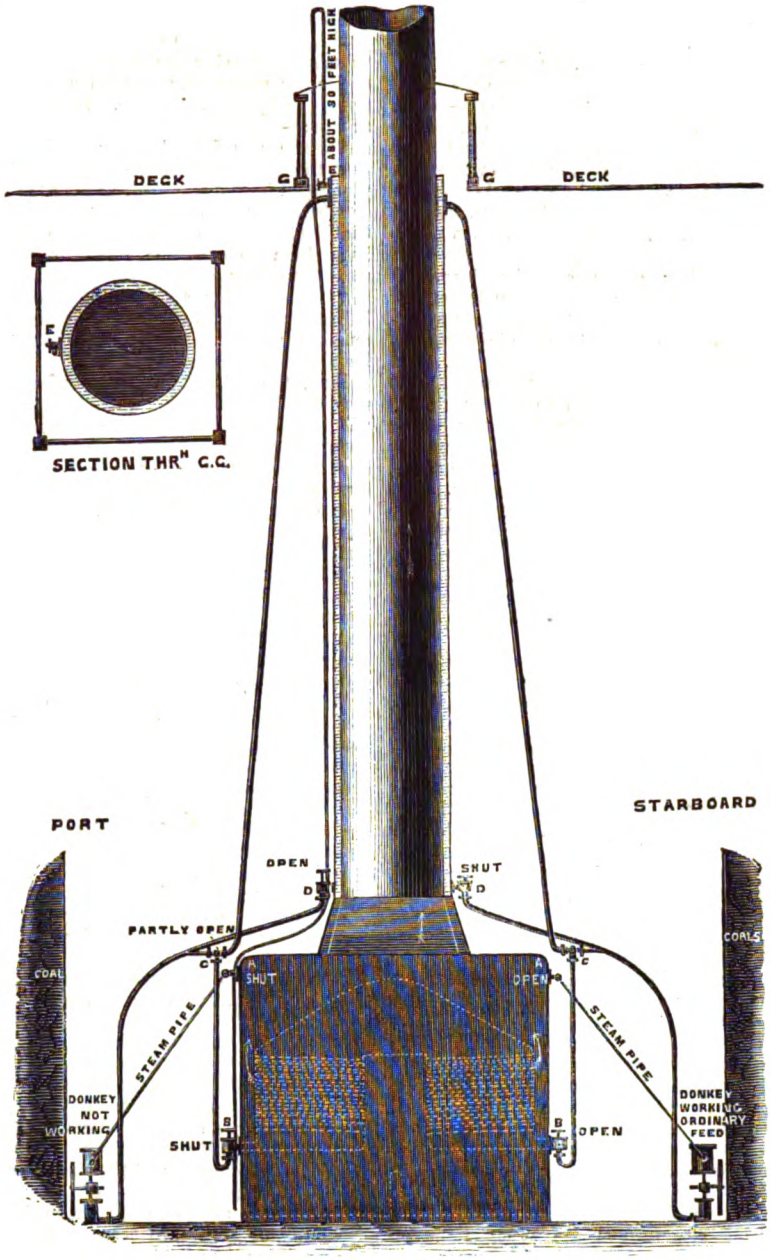
We have now described in detail an apparatus by means of which a man may in comparative safety proceed to his labour at the bottom of the sea Emigrant ships, and in fact all others, but more particularly screw vessels, if furnished with an apparatus of this sort, would be provided with the means of investigating the causes of leak, &c., and, in many instances, of counteracting their fatal effects without the waste of time which would arise from returning to port.

Possessing as Mr. Heinke's apparatus does so many advantages, it is not to be wondered that it is becoming every day more extensively used. The readers of the *Times* will have noticed that it has been employed upon many large works, and, amongst others, in removing the foundations of the old bridge at Rochester; in this instance some of the officers of the Royal Engineers were persuaded to descend in one of the dresses, and they did not, they tell us, experience any unpleasant effects.

THE GREAT EASTERN EXPLOSION.

Our readers will have observed that we have steadfastly refused to discuss the so-called scientific evidence given at the Weymouth inquest, our reason being that the newspaper reports of that evidence (which are the only ones accessible to us) differed so considerably as to be altogether unreliable. A scientific contemporary, the *Engineer*, regardless apparently of this consideration, took an opposite course, and published certain severe strictures upon some of the gentlemen who were examined. Among others Mr. Galloway, the Board of Trade Surveyor, was visited with criticism of a somewhat unsparing character. This has naturally enough given great offence, and has awakened in some professional gentlemen a desire to rebut the allegations and refute the arguments of our contemporary. For this purpose they have addressed a letter to us, alleging that so much unfairness and hostility to Mr. Galloway is evinced in the article of which they complain that they will not put themselves into communication with the editor who is responsible for it, and requesting us to publish their rejoinder. Now, to pacific persons like ourselves, such a proposal cannot possibly prove altogether pleasant, because the simple insertion of the letter of our correspondents may, for aught we know, be presumed to constitute an act of hostility to our contemporary, with whom we have not the slightest desire to wage war. But, on the other hand, since the reputation of a public officer has been attacked by him, and since we ourselves believe the attack to have been made too warmly (although not, we firmly believe, with any personal or vicious intention), we see no sufficient reason why we should refuse to aid in the vindication of the right. But then, again, our correspondents have written a very fierce letter, and have reciprocated the spirit of their antagonist very hotly, and we object to everything like heat or fierceness in what we publish; thus a new difficulty is created. Well, there is, happily, the good old golden rule to guide us even in this strait, and by its aid we may perhaps succeed in doing justice without giving offence. We will, therefore, do by our contemporary as we should wish him to do by us, by publishing our correspondents' statements as free as possible from what is splenetic or personal. If this course should give offence to either party we shall hold ourselves innocent of it, and arm ourselves for the consequences. As we dare not, of course, amend, but must simply omit portions of the following letter, we shall not attempt to bring it into a form in which we can wholly approve it. Some things will probably remain which we should prefer to see omitted, but which the necessities of the case require to stand. Intrinsically, however, the communication will be found of a most valuable character. In order to aid the reader in understanding the question, we have had engraved the accompanying illustration, showing the arrangement of all the cocks at the moment of the explosion. With these explanations we produce the letter, which (when pruned) runs as follows:—

THE GREAT EASTERN'S BOILER AND WATER-CASING.



TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

October 1st, 1859.

Gentlemen,—With the recent catastrophe on board the Great Eastern, the readers of our mechanical and other journals have been regaled these last few weeks almost to surfeiting, and in connection with this sad event has the propensity to mislead been singularly manifest, not only by much of the evidence given at the inquest, but by many of the various letters, comments, leading articles, and other effusions which have from time to time been introduced to public notice. Nor would we trespass on your valuable space but for a desire to correct several glaring errors to which the pen of a contemporary of yours, whose pages are devoted chiefly to the discussion of mechanical matters, has given publicity.

In an article in the *Engineer*, headed "The Great Eastern," a most unaccountable attack has been made on one of the witnesses who gave evidence at the inquest at Portland, and as the grounds of those charges are as absurd as they are at variance with truth, we beg your patient indulgence while we attempt to set the public right on points on which (thanks to the article we refer to, and others of a kindred character) they are grossly misinformed, and let us state at the outset that we shall speak of what we saw and know from facts, and not from any second-hand reports of the character contributed by "*our correspondent, a practical engineer.*"

The first indication of that disregard for truth which appears to characterise the writer of that

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article, is the extraordinary statement set forth in the report of the Portland proceedings that "he" (Mr. Galloway) "reported that the machinery worked well, and saw nothing wrong." To whom, may we ask, was this report made, and when? Was it to the Board of Trade before the ship left Deptford?—which, by the way, would have been somewhat premature—or to the Board of Trade on her arrival at her destination?—which seems scarcely consistent with common sense. Was it telegraphed from the North Foreland direct to Whitehall? No member of the Board was within 100 miles of the vessel, and no verbal communication was therefore possible. Allow us, then, to repeat the question, To whom and when was it made?

But the writer grows complimentary, and favours his readers with his solemn conviction that "of all the evidence at once oracular and impracticable which was elicited upon the inquest, that of Mr. Galloway must take the first rank. Mr. Galloway" (he further observes,) "does not stick at trifles, but is accustomed to deliver himself with a straightforwardness and energy which always goes far to enforce conviction." Now, this is not very delicate criticism, and exception might fairly be taken to it on several grounds. But there are questions of greater interest than that of this writer's good taste awaiting our consideration—questions of the deepest import to every one, whether concerned or not in this terrible tragedy; let us take them in order, and see how far the *Engineer* is justified in making his assertions.

There are at least six points on which he differs from Mr. Galloway, to say nothing of those on which he differs from every one else:—1st., the quantity of water in the heater at the time of the explosion; 2nd, the temperature in the chimney; 3rd, the use, or otherwise, of the stand-pipe as a safety valve; 4th, the strength of the heater; 5th, the pressure acting on it; and, 6th, the immediate cause of the explosion. Let us look at these singly and briefly.

First, then, as regards the quantity of water in the casing, the *Engineer* observes:—"The heater, however, *must* have been nearly or quite full of water at the time of the explosion; it must have been left full after the donkey had ceased to pump through it, and the stop-cock being shut there was afterwards no outlet whatever for either steam or water." What a pity it is the *Engineer* did not either go into this matter himself or make more searching inquiries of "our correspondent" before he arrived at this conclusion. Notwithstanding the terrible emphasis he lays on that little word *must*, let us assure him that one of these cocks WAS open some time after the donkey engine had ceased to act. The *Engineer* is probably not even aware that each boiler was fitted with *two stop-cocks*. Such, however, is the fact, and if "our correspondent" had made the inquiries which others did he would have learned that although one was securely shut the other had been *partly open*; and there is reason to believe continued so till within an hour or two of the explosion. With this cock open so long after the feed was shut off, there could have been but a very little water in the casing. But independently of this—which is a most important consideration—the fact that there was only a small quantity of water there is corroborated most satisfactorily by the appearance of the plates after the catastrophe had occurred, many of them exhibiting indubitable proofs of having been *red hot*. With these facts before us we would recommend to the *Engineer* a re-consideration of that little word "*must*."

In noticing our first point of difference, it will be seen that we have to some extent anticipated the second—the heat of the funnel. We cannot help remarking, however, in passing, that effective indeed must be that boiler that can usefully employ so much of its heat for evaporative purposes as to leave only 325° to escape through the chimney. There are few marine steam-boilers where it would not be found, if a pyrometer were inserted at the base of the chimney, that 1000° instead of 325° passed away unemployed. The data, therefore, on which the *Engineer* rests his assumption, that the constructors of these boilers never supposed the water in these casings would boil, is somewhat difficult to comprehend.

3rd. The stand-pipe as a substitute for a safety-valve in this case is next denounced in terms neither choice nor measured, and with a confidence and energy delightful to observe. Here is an extract or two:—

"Steam was formed faster we have no doubt than the small cock in the bottom of the stand-pipe could have discharged, had it been open."

"Such of the witnesses as stated under oath that had the stop-cock been open there could have been no explosion, certainly stated much more than they could possibly have known."

"We still believe that the stop-cock, even had it been open, would not have furnished a sufficient outlet for the steam which the heater proved itself capable of generating."

Now, the efficiency of this unfortunate cock may be settled in a few words. If the *Engineer* will take the trouble to read the evidence of Mr. James Patrick, as it is reported in the journal we have referred to, he will find that after the explosion he went immediately to the cock on the after chimney, and finding it closed, opened it; whereupon it discharged the pent-up steam, and acted well during the remainder of the voyage. Now, if this cock was large enough to discharge the accumulated contents of this jacket (for it is reasonable to suppose there was a considerable volume of steam in it), as well as the quantity being generated during the time of the discharge, does it not appear reasonable that it should be sufficiently large to pass off any quantity that could be formed in the ordinary process of evaporation. If large enough to give easily free egress to a body of steam all but capable of rending it, surely it was every way adequate to fulfil its legitimate functions.

4th. The strength of the chimney to resist the external pressure is thus spoken of:—"As a boiler it had one flue 6 ft. in diameter, and 40 ft. long—the iron being half-inch thick—and without stays of any kind." Without stopping to inquire into the desirability of staying circular boilers—a practice by no means common in the neighbourhood of London—allow us to observe that if "our correspondent" had taken the advantage of the detached part of the funnel lying on the deck to examine its interior, he would doubtless have seen, as others saw, that it was stayed about every 4 ft. or 4 ft. 6 ins. from the uptake upwards with stays not unlike a flattened tripod, three bars radiating at equal distances from one common centre, and securely attached at their extremities to the periphery of the circle. Admitting, therefore, the correctness of Mr. Fairbairn's theory, which allows to the external cylinder a capability of resistance between three and four times greater than the interior one *when unstayed*, the presence of stays in this instance would tend greatly to equalise the relative strength of the two, if, indeed, the flue or inner cylinder would not by this means be made even stronger than the other. I refer to this chiefly as clearing the way for the next question.

5th. The pressure in the casing. In the report of his examination at the inquiry, Mr Galloway was made to say that in his opinion "the collapse and consequent explosion resulted from a pressure of at least 500 lbs. per square inch." Now this, as will appear from a letter received from him on the subject, and a copy of which will be found appended to this, is incorrect. "The question was not what was the pressure in the heater at the time of the explosion," but "what was the force that produced the explosion," or words to that effect, to which he readily replied a force of something more than 500 lbs. on the square inch, clearly indicating that he attributed the collapse, the explosion, and the leaping of the funnel into the air, to something more than the mere pressure of the steam. But more of this anon. That the steam confined in this casing had acquired a fearful degree of density is unquestionable; that it was more than the *Engineer* supposes, or even twice that, is exceedingly probable. The great heat to which that small quantity of water was subjected, and the fact that for an hour or two all escape was prevented, making such a conjecture in the highest degree reasonable.

But we must hasten to the sixth and most important matter to be discussed, to wit, The immediate cause of the explosion.

In coming to this question we have, we shall presume, established satisfactorily, among other things, three very important points, all of which we shall do well to bear in mind while proceeding to the consideration of the most vital question of all. We have seen that a very small quantity of water in the heater at the time of the collapse is more than a mere probability, indeed, it might be almost established as a certainty. We have seen, too, that the plates of the inner tube or chimney were at the same time, on account of the great heat to which they were exposed, in a condition but little able to resist the pressure from without; and the third question, of the amount of that pressure, though it can never be accurately determined, may be safely stated for argument's sake at 75 lbs. per square inch, an ample force to do what it did. Now, put these three together, and ask any man whose intellect is not hopelessly obtuse what the result must be, and ninety-nine out of every hundred would unhesitatingly affirm that the internal flue in its weakest part would collapse; that when the water came in contact with the red-hot plates hydrogen gas would be formed; that if only a small aperture was created by the flattening of the flue this gas would burn with a steady jet of flame, and thus escape harmlessly into the chimney; but, that if it was *rent* and a rupture of any magnitude formed, the oxygen in a large quantity meeting the other at the mouth of the orifice would *explode* and produce results strongly resembling those of gunpowder. We take it that any man not absolutely in a straight waistcoat would, if these facts were placed lucidly and succinctly before him, state this as his belief. And is it not reasonable? What more probable than that the red hot flue should yield to the surrounding pressure? A force of considerably less than 75 lbs. per sq. in. would accomplish this. What more natural to suppose than that in bending it should break and open an extensive communication between the chimney and the casing? And what, when this was effected, was to hinder the ordinary chemical combination and its results?

But the combined evidence of Messrs. Faraday, Brande, and Taylor are shaken at the unfortunate Surveyor like a rod at a boy, and his attention directed thereto as a something which, if marked, learned, and inwardly digested, is likely to do him good. Verily we are at a loss to see anything in either of these reports, which are now lying before us, affecting the question. Let one or all of these learned gentlemen assure us, if they can, that oxygen and hydrogen of equal proportions, or nearly so, if brought into contact under these circumstances would not produce an explosion, and explain why, and we will see what light *that* throws on the matter; but until we are shown that, we must remain sceptical on the *Engineer's* theory that it was only an excess of steam in the casing.

Again, if the *Engineer* will put pencil to paper and ascertain the force required to separate in the direction of its length a cylinder 7 ft. in diameter and ⅜ in. thick, he will not be long probably (or ought not to be) in discovering that it would require a strain of about 1,890 tons to tear these plates asunder; and when it is remembered that after it was dissevered this piece of funnel and casing, weighing of itself between 11 and 12 tons, was shot 30 feet in the air, breaking in its ascent the waste steam and other pipes attached to it as well as the funnel stays which secured it to the ship, will it, we ask, be entertained by any man in his senses that all this was effected by a paltry pressure of 75 lbs. per square inch?

Another and very remarkable appearance presented by the outer casing is strongly suggestive of the fact that some other power than mere high pressure steam produced the havoc of that dy-

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On examining the detached piece of funnel on deck, the outer cylinder was observed not only to have retained its shape in the most perfect manner, but with the exception of the granular and serrated appearance of the fracture, one would almost have supposed it had been cut off in a lathe, so regular and even was the line at which it parted; and this, too, while the internal flue was crumpled up like a sheet of paper under the pressure of the hand. Does not this convey the idea that some irresistible power acting *suddenly* and forcibly—some power of which, probably, we know but little—was at work, and not only disconnected the upper part of the funnel, but lifted it on deck afterwards? A little below this line a piece of plate a foot and a-half or more in area, was forced clean out of the solid metal, and that, too, without affecting the parts contiguous to it, just as we sometimes see a hole made through a pane of glass by a quick sharp blow, without leaving the trace of a star.

We might multiply proof upon proof, but enough has been said to place beyond all doubt the fact that something greater than the force of steam, even of twice or thrice 75 lbs., did the execution of that terrible evening. What a thousand pities that the writer of that article did not think twice, or at all events inquire twice, before he wrote once. But, we presume, it is "our correspondent" the "practical engineer" who is to blame—perhaps so.

The very flattering allusion made in the article we allude to by its highly-gifted author to Mr. Galloway, the latter gentleman must fully appreciates; if not, he deserves to suffer the consequences. It runs to the following effect:—

"From the evidence of such men" (Professors Faraday, Brande, and Taylor) "the public will perceive how to estimate that of Mr. Galloway, which is, if possible, more ridiculous than the notable report which a few individuals busied themselves in getting up soon after the explosion," &c., &c. Now, we can see no difficulty in reconciling the statements in both Mr. Galloway's evidence and the report of these great chemists. To our mind they agree marvellously.

Thus much, Gentlemen, on this matter. Let us in conclusion observe, first, that the statement in the paper just quoted, that "in regard to the actual connection of the pipes, no explanation appears to have been given at the inquest," &c., is entirely without foundation—we might almost use a stronger term. The fact is, Mr. Galloway drew out an elaborate plan, showing the arrangement of the pipes, cocks, donkeys, &c., and explained the details of the accident by its aid, it being spread at the time on the table at which the jury were sitting. We might further also observe that at the conclusion of his evidence the jury expressed their acknowledgements to Mr. Galloway for the information they had derived from it. Where was "our correspondent," not to have seen all this?

But even the verdict does not please this amiable man; he grumbles because the jury found, what he affirms "no human tribunal" was competent to find, or, in other words, what *he* would not have found, viz., "that the bursting was caused by the closing of the tap," &c. Why, what on earth would he have had the jury do? Did not every fact that was elicited point to that as the direct and immediate cause of the calamity? Was it not clear enough for every simpleton to understand? And yet it almost seems not. There are some people who shut their eyes at noon-day, and call it night—who argue in foregone conclusions, and make the result of their deliberations accord with their preconceived notions; twelve such men would be a treasure of a jury. With a very slight stretch of the imagination we can conceive their verdict in this case; it would in all probability be something to the following effect:—*Died by the visitation of some demon of mischief, though what he did, or how he did it, there is no evidence to show.*

We are, Gentlemen, most obediently yours,

COMMON SENSE.

[COPY.]

6 Adelaide-place, London Bridge,
Sept. 26, 1859.

MY DEAR SIR,—Thanks for drawing my attention to the article in the *Engineer*; it is quite clear I have been misunderstood about the pressure. I am sure no person will believe that I considered more than 400 or 500 lbs per square inch would be necessary to collapse the inner casing (which I believe to have been red hot); what I meant to convey (and trust I did to some people) was, that it would require more than 400 or 500 lbs. to separate the outer casing.

The question was put to me after I had stated the inner casing collapsed, &c., and I naturally inferred it applied to the bursting of the outer cylinder.

The article in the *Engineer* I consider of too personal a character to reply to, but please set the matter of pressure right with your friends.

I am sure you will consider my experience with boilers sufficient to know that it does not take very great pressure to force down the crown of a furnace when red-hot.

I am, my dear Sir, yours very truly,

R. GALLOWAY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I am not about to discuss the question who was in charge of the engines and boilers, or who was the cause of the explosion, having only a right to interfere on public grounds, and to further the research as to the real cause with a view to a prevention of such calamities.

I have for a considerable time called the attention of the public to the frequency of boiler explosions, and their probable increase unless more attention be paid to the construction and management, and more particularly to that form of boiler known as the Cornish boiler, in which the pressure is exerted upon the outer portion of a cylinder. In April, 1855, I wrote a letter to the *Manchester Guardian* paper on this particular form of boiler, which begun thus:—

"Another boiler explosion, attended with a lamentable loss of life, is recorded in your journal of this day. Pending the judicial inquiry which must take place into the facts of that case, I do not intend to comment on the details as set forth in your report, beyond calling attention to the fact, that the part of the boiler which has given way and occasioned this lamentable catastrophe, is one of its *internal flues*, which had to sustain a great pressure exerted externally upon its cylinder-like form, and which at length failed under the strain to which it was subjected. The many instances of boiler explosions arising from the collapse of internal flues of this character, ought surely to induce a more serious inquiry than the subject has yet received, with the view of ascertaining whether boilers of this, the favourite form of construction, are safe, when worked at the high pressure now deemed desirable, or, indeed, at any considerable pressure; or whether a collapse of the flues is not a certain result of the force so applied, and in the best of boilers, and under the most favourable conditions, *only a question of time.* For myself, from inquiry and reasoning upon the subject, I have long since arrived at the conclusion that this form of boiler, whether of the kind known as the Butterley or the Cornish, is not safe;" and at Leeds, last year, I read a paper on the subject before section G of the British Association, which you were kind enough to publish in the MECHANICS' MAGAZINE of Oct. 23rd, 1858. The portion of the boiler that exploded on the Great Eastern was the portion of the flue or chimney extending from the top of the boiler to the upper deck; that flue or chimney was surrounded by another cylinder 12 inches larger than the internal flue, being seven feet diameter, leaving a water space of six inches betwixt the flue and the case, and extending in height, or length, forty feet from the boiler, which, when charged with water, would exert a pressure of 18 lbs. per square inch at the bottom, internal to the outer shell or case, and external to the flue or chimney.

The outer shell, or case, was provided with an open stand-pipe from the bottom, and extending to a height of twenty-five feet above the top of the case, and in the form of an inverted syphon, the descending pipe being attached to the top of the outer shell. At the extreme height, and in the curve of the syphon, a half-inch hole was bored, and at all times open to the atmosphere; on the descending leg of the pipe just at the top of the water-space was inserted a stop-tap, to cut off the communication of the steam from entering the descending pipe, or short leg of the syphon.

Having now described this portion of the boiler to the best of my information, I will now endeavour to explain the cause of the collapse of the flue. It was stated in evidence that the supply of water to the outer case was stopped, and that the tap on the short leg of the stand-pipe was closed; such being the case, I shall endeavour to show that the construction of water heater of this peculiar description is one highly dangerous, not on account of the heat which traverses its surface, but from the fact of a 6-feet tube being exposed to the pressure which would be exerted external to its diameter.

Many parties imagine that the heat given from the furnaces when passing up the chimney would be at a very high temperature, and consequently there would be a rapid generation of steam in the case; and by the tap being closed there would be an immense pressure brought to bear upon that chimney, or flue, or water-heater. In the first place I assert the heat thus traversing through the flue would never exceed 450 degrees Fahrenheit, and I very much question whether it would reach 350 degrees in so large a space as a 6-feet diameter flue. In making this statement I do not merely imagine such would be the heat given out; my conclusions are from the actual test of a similar boiler; but I will grant that the temperature was 450 degrees in the flue, at which temperature it would at the very least take twelve hours to get the water in the case to boiling point, and to generate a pressure of steam of 20 lbs. above atmosphere would be 260 degrees in the case, which I aver was never the case in the exploded funnel.

It now remains to prove the real pressure of steam that would have to be generated in the heater sufficient to force the water out at the top of the pipe. It must be borne in mind that the 1¼-inch stand-pipe was inserted in at the bottom end of the case, and was open from end to end, extending to a height of twenty-five feet above the top of the case, and that there was a ¼-inch hole at the top to let out the steam from the heater, or, as in the case at the time of the explosion, to let out the water when the tap on the top of the water heater was closed. There requires no comment as to the probable pressure of steam in the case; a pressure of 11 lbs. per square inch was sufficient to force the water out at the top of the pipe, and thus I come to the undeniable conclusion that the steam in the case did not exceed 11 lbs. per square inch at any time; had the tap been open the half-inch hole would have been sufficient to have discharged as much steam as twenty such water heaters would have generated.

Having now proved that the steam pressure could not be more than 11 lbs., I come to another feature regarding the pressure brought to bear externally upon the 6-feet diameter. The water-heater, as described, was forty feet high, and unless it was completely filled with water, none could be supplied to the boiler; thus a column of water of that height would exert a pressure of nearly 18 lbs. per square inch at the bottom end of the case, and that added to the pressure in the stand-pipe gives a total of 29 lbs. per square inch, as being the extreme pressure that could be brought upon the water heater; now the question arises at what pressure did that internal flue collapse; it is perfectly clear that it collapsed at less than 29 lbs. per square inch; therefore, the flue must have been weaker than the stand-pipe denotes, being constructed, as they perhaps presumed, to work with safety at 29 lbs. per square inch.

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Now I have repeatedly called the attention of boiler owners to the case of the Victoria, whose boilers twice collapsed and killed eleven persons. A searching inquiry took place as to the cause.

The Victoria exploded in 1838; the flues were six feet diameter, made of ½-inch Low Moor plates, and collapsed at a pressure of 13 lbs. per square inch, viz., 10 lbs. of steam, and 3 lbs. of a column of water. She was repaired, and again collapsed at the same pressure. The collapse on board the Great Eastern is precisely similar, except that the flue is six feet diameter, with ½-inch plates, yet we find that although double the thickness of the Victoria, there is no proof that it took more or less than double the pressure, 26 lbs., to collapse the flue on the Great Eastern, as there was no means of ascertaining what was the height of the column of water in the stand-pipe; but certain it is that it collapsed under 29 lbs. pressure. I am fully persuaded that the cause of the collapse of the flue on the Great Eastern was from defective construction, and that the pressure exerted external to the six-feet flue was too much for that diameter to resist.

As a water heater I should denounce it as being highly dangerous, arranged as it is, in having a stand-pipe attached so as to increase the pressure to such an extent. There is no doubt that the impression was that the flue was sufficiently strong to carry that pressure, otherwise the stand-pipe would not have been erected, and therefore the blame is not justly on the person who closed the tap; although I acknowledge the explosion would not then have occurred had the tap been open; but it remains with those who applied the stand-pipe, whether they considered the flue sufficiently strong to resist the pressure the stand-pipe would bring upon it in case of the tap being closed. I cannot but think that such was the opinion, or why have carried that stand-pipe to such an elevation? Many instances of collapse similar to the one already mentioned could be adduced.

Having occupied so much of your space, I will not detail them, but I trust a reminder of the dreadful occurrence will cause a thorough inquiry whether the economy attendant upon the use of those large and dangerous vessels for heating water in connection with the boilers is really so efficacious as imagined, or whether they might not be made more useful for heating water for ships' purposes.

Your obedient servant,

J. HOPKINSON.

Britannia Works, Huddersfield, Oct. 4th, 1859.

AERIAL NAVIGATION.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—This subject having been revived since I wrote to you thereon (see MECHANICS' MAGAZINE, vol. 50, p. 439), I beg space for a few remarks.

Balloons have long fulfilled two of the requirements for navigating the air; viz., ascent and descent at the will of the aeronaut. Two more requirements, however, exist, the ability to travel in any required direction and against any wind, and steerage. These desiderata present formidable mechanical difficulties, but not, I think, insurmountable ones. Steam-power and a proper form must be adopted. The air in a hurricane is stated to travel at the rate of 80 miles an hour, and to exert a pressure of nearly 32 lbs. per square foot. The aerial vessels should, therefore, be able to travel at the rate of 100 miles an hour, at which rate the pressure of the air would probably be nearly 50 lbs. per square foot of flat surface. To reduce the resistance I should propose a vessel of the form shown in the diagrams: Fig. 1, a side view, and Fig. 2, an end view from the head. Great size is indispensable: say 800 feet long by 100 diameter. This would displace about 150 tons of atmospheric air, and probably a light high-pressure boiler and engine, with surface condenser, working up to 1,000-horse power, would propel it in the teeth of a hurricane; but as violent winds are seldom met with at any great height, a much smaller power would generally

FIG. 1.

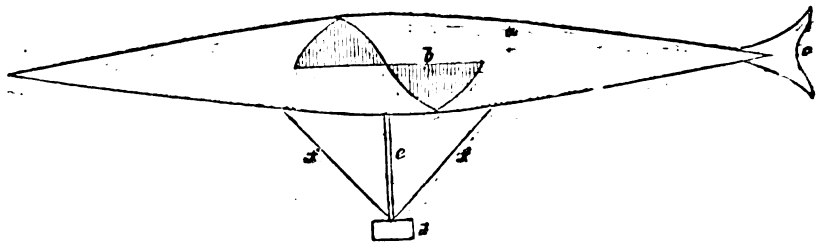
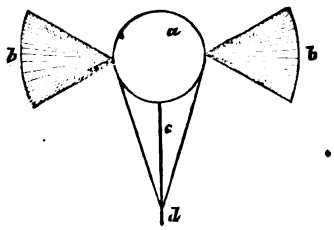


FIG. 2.



suffice. However, as at the end of a voyage a gale may be blowing, the power should be at hand.

In the diagrams *a* is the body of the vessel. This may be made of light woodwork, or very thin steel or copper, on the cellular plan for insuring stiffness with little weight. Timbers of wood perforated with centre-bits would be light and strong. Partitions should be made with cross and longitudinal bulkheads, a centre division being the engine-room, &c. Each compartment (except the engine-room) should have an air-tight bag made to fit it internally, but not fixed in any part, so that it may be wholly or partially filled with hydrogen gas, but never quite filled. The weight of the gas would be about 10 tons—engine, say 50 tons; leaving 90 tons for the hull, propellers, crew, provisions, fuel, &c. *b* is one of the propellers. These may be formed of canvas or india-rubber cloth, with tubular ribs or extending arms. By connecting each arm with a separate crank, say 36 arms and the same number of cranks, each one set 10 degs. away from the next, a perfect wave motion of the wings will be obtained, far preferable to any screw propeller.* *c* is the tail or rudder, which would move in a similar manner to the tail of a fish (the mechanism would take too much of your space to describe, it is, however, light, and not easily put out of order), and moves in a curve, unlike a rudder. *e* is a spar for supporting the ballast *d*, a flat piece of iron to keep the hull upright, and by the ropes *ff* to assist in ascending and descending, by pulling upon the aft or forward ropes, and causing the head to incline upwards or downwards.

If such a vessel as the above can be constructed the mails may be carried to Australia in six days. Captain Norton could also make use of it in war, the balls and shells being merely *dropped* upon the enemy; guns of any kind not being requisite.

I have not made any experiments upon the resistance of different forms moving in air. A hundred miles an hour would be 1,800 feet per minute; the area of midship section would be 7,854 feet, and by finding the resistance per square foot of section of a given form, the required horse power may be calculated.

Writers on this subject speak of birds as inflating their quills, &c., with air for the purpose of altering their specific gravity. I think they perform the latter by producing a vacuum. And if the above vessel can be made to bear fifteen pounds per square inch external pressure, a vacuum might be formed by the engine, and ten tons weight of gas, and about the same weight of air-tight bags, would be saved.

I am, Gentlemen, your obedient servant,

T. MOY.

Clifford's Inn, Oct. 4, 1859.

THE GREAT EASTERN TRIAL TRIP.

PADDLE ENGINES.

WE have been furnished, at the last moment before going to press, with the following statement, which we believe to be reliable:—

Started from Portland October 8th, at 3.45 p.m. Draught of Water, 20 feet 6 inches fore, 25 feet aft.

Lights.	Time of passing.	—	Distance in Knots.	Length of time.	Speed per hour.	Average Revols. per Min.	Time.	No. of Revols.	Average per Min.
Bill of Portland	5.40 p.m.	Bill of Portland to Eddystone.	73	5.30	13·27	9·41	5 to 8 p.m.	1755	9·75
							8 to 10 ,,	1050	8·75
Eddystone	11.20 ,,						10 to 12 noon	1150	9·58
					Oct. 9th.				
		Eddystone to Bishop's.	87	8.10	10·85	9·06	12 to 8 a.m.	4290	8·93
Bishop's	7.30 a.m.						8 to 12 noon	2210	9·20
							12 to 4 p.m.	2500	10·41
		Bishop's to Kinsale.	137	10.30	13·04	9·94	4 to 8 ,,	2450	10·20
Kinsale	6.0 p.m.						8 to 12 m n.	2150	8·95
					Oct. 10th.				
		Kinsale to Tuscar.	103	8.30	12·11	9·11	12 to 8 a.m.	4152	8·65
Tuscar	2.20 a.m.						8 to 12 noon	2250	9·39

Total distance run from Bill of Portland Light to Tuscar Light, 400 Knots
,, ,, ,, by Paddle Wheels ..... 456 ,,
Giving a slip of ..... 14 per cent.
Diameter of Wheels 56 feet outside Floats.
Floats reefed, ... 2 feet 6 inches.
Giving diameter of Wheel, 51 ,, 0 ,, outside Floats.
Effective diameter on trial, 48 ,, 0 ,, (From centre to centre of Floats).
Number of immersed Floats on each Wheel, 6.
Size of Floats, 3 feet by 13 inches.
Total area of immersed Floats, 468 square feet.
Total area of immersed Midship section, 1588·38 square feet.

Total Steam Pressures:—(Vacuum 27lbs.)

From starting at 5.0 p.m. to 8.0 a.m. October 9th ..... 17lbs. in Boilers.
,, ,, 8.0 a.m. ,, 8.0 p.m. ,, ... 22 ,, ,,
,, ,, 8.0 p.m. ,, 8.0 a.m. October 10th ..... 17 ,, ,,
,, ,, 8.0 a.m. till Engines stopped ..... 22 to 25 ,, ,,
Consumption of Coal, at the rate of 95 tons 6 cwt. 28lbs. in 24 hours.

* A similar propeller may be constructed for steam-vessels.

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SCREW PROPELLERS AND THEIR CONSTRUCTION.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—The study of this valuable and important marine agent having engaged my attention for upwards of seven years will, I trust, be a sufficient apology, not only for my offering a few suggestions on the same, but also claiming a space in your valuable journal for their insertion, especially as the subject is taxing at the present moment, to the utmost extent, the minds and intellect of the scientific world. Numerous reports of trial trips, and letters from various individuals, claiming and also advocating certain curves and twists in the formation and construction of the blades or fans have from time to time occupied much of your space, still we find little or no progress made (see *United Service Gazette*, 3rd ult.), either as regards augmentation of speed or reduction in its vibration, evidently proving that an egregious error in its construction still exists.

The appellation of *Screw* being associated with this submarine propeller has been fatal to its progress or improvement, inasmuch as the idea fostered, and, strange to say, still cherished, is that it must necessarily partake or assume a screw-like construction by imparting certain curves or twists to the blades; numerous claims (as before observed) have been made to these strange dogmas and appliances, each contending for that which is not only perfectly useless, but in fact injurious, in confirmation of which allow me to ask, Do we find a curve or twist imparted to the vanes of a windmill? or the smoke jack? or the simple toy which we sometimes see children bounding along the streets with? Certainly not; on reflection it must be obvious that its presence in either case would be a serious drawback, it might, therefore, be reasonably inferred that wherever it exists in the screw propeller, an exuscitating or flounder-ing tendency must be and is produced, instead of the water, on the contrary, being extruded off parallel with the boss, leaving little or no trace of the propeller. Other injurious results consequent on its presence are produced, viz., vibration—also unnecessary absorption of steam-power, arising from its inability to work freely, resulting also in loss of speed.

Vibration is also produced from other causes, viz., the screw working into instead of independent of the stern-post; two-bladed screws tend considerably to increase the same, arising from their absence of uniformity of power, one blade frequently being only partially immersed, and at the same time seriously affecting and inflicting considerable wear and tear to the engines, disadvantages and drawbacks which cannot be got rid of with the lifting screw.

Having adverted to some of the causes and drawbacks under which this submarine propeller is labouring, the question asked will be, Are they surmountable? Unquestionably they are.

In the construction of what is designated the screw propeller, preference should be given to surface rather than to long narrow blades, avoiding angles and curves (as before noticed), especially guarding against the greater amount of surface encircling the boss (as some screws are constructed). This is a sad mistake, from the circumstance of its close approximation to the centre, being the most sluggish and inactive part: here the water should have a tolerable free passage, and must produce a drag of no ordinary character. Again, no real or satisfactory results can be expected or achieved until the pitch is at all times alterable in order to meet every contingency, the absence of which has been long felt in the steam screw marine, an object most desirable and paramount towards its development and solution, it being a well-known fact that two vessels constructed in every respect alike, engines and screws the same, still the speed of one shall be greater than the other—a powerful argument, indicative of the utility and advantages alone possessed by the feathering screw.

In conclusion, I would briefly recommend and also advocate the adoption of the feathering screw for the reasons before assigned; secondly, flat circular blades (see MECHANICS' MAGAZINE, No. 24, June 10th, page 381); and lastly, four blades, the combination of which would be found to entirely dispense with all the aforesaid drawbacks, and secure a greater speed than has ever yet been attained. Respectfully apologising for having occupied so much of your valuable space,

I have the honour to be, Gentlemen,
Your most obedient servant,
WILLIAM HEWITT.

Bristol, October.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements

To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

Our Weekly Gossip.

A correspondent writes:—"In the *Times* of this day (Wednesday), the special correspondent writing from Holyhead, tells us that the little rolling which took place during the passage round, was owing to the centre of gravity being below the centre of motion. I should be glad to learn how it is that the Great Eastern has a centre which no other ship was ever known to possess, inasmuch as the centre of gravity is as much a centre of motion as any other point in the ship, there being (in the act of rolling), motion about every point in the ship as a moveable centre, and about no point as a fixed centre."

The troop ship John Duncan, now lying in the London Docks, affords another remarkable instance of the advantages of having an *efficient means of lowering the boats on ship-board*, and we may well infer, if the use of such a means for saving life has been turned to such good account (three lives having been saved on different occasions in the single voyage of one ship), what general public advantage must ensue if such were carried in all ships. We again proclaim the painful fact, that ships in the Royal Navy and government, emigrant, and troop and convict ships, are almost the only ships in which anything of the kind is ever taken. The log of the John Duncan, in which ship Clifford's lowering apparatus was fitted in accordance with the Government charter party, by order of the Admiralty, states, "That in latitude 32° south, and longitude 78° 30′ east, when the ship was going 8½ knots per hour with a heavy cross sea, the starboard life boat was lowered by it, with an officer and six men, to pick up one of the soldiers who had fallen overboard from the forecastle deck; that the man was picked up, and in fifteen minutes the boat was again at the davits, and the man in his cot." Again, "while on the passage from Calcutta to Trinidad, with coolies, when in latitude 1° 17′ north, longitude 89° 22′ east, at 4·30 a.m., one of the coolies fell overboard, but the same boat was again lowered, and the man picked up in ten minutes, although the ship was going nine knots the hour at the time." The last occasion was "when in latitude 21° 14′ south, and longitude 8° 27′ east, while the ship was going 5½ knots, another of the coolies fell overboard, and in six minutes after he was picked up through the same means."

The following letter on a similar subject deserves a place:—

11 Victoria Terrace, Notting Hill, W.,
12th October, 1859.

GENTLEMEN,—As you mention with reference to the recent meeting of the British Association at Aberdeen, that my paper on my recently patented invention for disengaging ship's boats at sea was not read, I beg to inform you that the omission was solely in consequence of my urgent and sudden recal to duty earlier than I had anticipated before setting out for Scotland. I wished very much to have availed myself of the opportunity thus afforded me of making it publicly known, and especially to the naval authorities, whose attention I wished more particularly to engage, as my method would tend considerably to facilitate the manœuvres of H.M. ships of all classes, and particularly of gun-boats, and such as work in shallow water when disembarking men and landing assault parties under fire of batteries (especially if the latter be fitted with the revolving stage or slide, as noticed in your paper), after the manner of those at Cherbourg. My plan does not require the vessel to stop, but keeping at high speed renders it exceedingly difficult for her assailers to keep up their attack at once upon herself and boats by reason of the facility with which the latter would be disengaged unknown to the enemy. Thanking you for your kind notices, and trusting to be able at some future time more fully to demonstrate the utility of my invention,

Believe me, Gentlemen, yours faithfully,
E. A. WOOD.

The following letter on the Government specification for the Gibraltar cable may be read with advantage:—

30 Addle-street, Wood-street, London,
October 5, 1859.

GENTLEMEN,—I was much pleased from your last week's Magazine to find that the Government of this country were going to have a submarine cable laid between Falmouth and Gibraltar, but I was surprised to hear that a contract had been entered into with the Gutta Percha Company for making the core, as I find there is a specification put out by the Government for the purpose of giving a contract for the external covering, completion, and the very hazardous undertaking of laying the cable. We are, therefore, to have this great undertaking carried out in the above form, and I cannot but notice the undue and unfair share of responsibility which is to devolve on the two contractors. In the first place, the interests of the Gutta Percha Company appear to be well considered. They make the core and test it on their own premises, and, if perfect, receive their money, and thus ends their responsibility. The contractor for the remaining portion is to bear all other risks, such as removal, variations in temperature of the atmosphere during process of covering, and finally, the laying down; and then subject to forfeit the sum of £20,000 if the insulation is not kept perfect for thirty days. Now, Gentlemen, should the continuity be affected when the cable is at the bottom of the sea, I am at a loss to understand who can determine whether the fault will be in the core, or in the external covering not being properly applied. I am sure you will excuse me troubling you with these remarks, but in a matter of such great national importance I think you will agree with me it is desirable to obtain every information, especially as I feel certain the manufacture of submarine telegraph cables must be very imperfectly understood, as none of the lines hitherto laid, of any magnitude, have lasted perfect for any length of time. I fear I have trespassed too far on your space, but should you consider these remarks worthy of a space in your valuable publication, you will oblige your obedient servant, A SUBSCRIBER.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 644, 651.

BOILERS AND THEIR FURNACES, &c. *None.*

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 649, 655, 665.

SHIPS AND BOATS, including their fittings, 659, 671.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 648.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 663.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 641, 648, 650, 957, 658, 668.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 636, 642.

LIGHTING, HEATING, AND VENTILATING, 637, 653, 672.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 633, 640, 647, 654, 667.

METALS, including apparatus for their manufacture, 646.

CHEMISTRY AND PHOTOGRAPHY *None.*

ELECTRICAL APPARATUS, 639, 653.

WARFARE, 662.

LETTER PRESS PRINTING &c. *None.*

MISCELLANEOUS, 634, 635, 638, 642, 644, 652, 655, 656, 660, 661, 664, 666, 669, 670, 674, 675.

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633. W. E. NEWTON. "Improvements in the manufacture of shoes and other coverings for the feet." (A communication.) Dated March 12, 1859.

This consists in the manufacture of shoes with their uppers of woollen or other cloth, or felt, and with a sole foxing and binding of india-rubber. *Patent abandoned.*

634. J. PALMER. "A new or improved trap for catching animals, birds, and fishes." Dated March 12, 1859.

This trap consists of a bar of iron to which two hooks are connected. One of the hooks is capable of sliding for a short distance along the said bar, and by its sliding motion to move a small lever at the end of the bar opposite to that at which the hook is situated. The hook described is provided with the bait. The other hook turns upon the joint upon the bar and when thrown back is held by the lever actuated by the bait-hook. A strong coiled spring throws the jointed hook forward with great force when it is disengaged from the said lever. *Patent abandoned.*

635. J. T. CALOW. "A compound action in cage machinery, with the apparatus connected therewith, having a perforated shield for saving life and property in the event of a rope, band, or chain breaking, or the engine-man drawing the cage too high at coal or other shafts, where slides are applicable, which said invention is also applicable to hoisting or other lifting machines." Dated March 12, 1859.

This consists in the use of two chairs, or a double chair and a perforated shield, which by means of certain levers, joint-rods, and springs prevent the fall of the chair in the event of the rope or chain breaking. There are various details included. *Patent completed.*

636. J. THORNTON. "Improvements in machinery for the manufacture of bricks, tiles, and other similar articles." Dated March 12, 1859.

The principal feature here is in the manner of forming the mould or die, which expands at the time for introducing the rough clay, the sides remaining upright, and the corners or angles remaining closed. The mould is formed of two vertical sides; two of these sides act as jaws to hold the others. These jaws traverse backwards and forwards, carrying with them the other two sides, and on compressing the clay slide between two metal plates which form the top and bottom sides of the bricks. *Patent completed.*

637. J. COURT. "An improvement in nibs for gas-burners." Dated March 12, 1859.

This invention was described and illustrated at page 185, No. 38, Vol. 2, of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

638. R. ALLISON. "Improvements in apparatuses for boring and sinking." Dated March 12, 1859.

This invention was described and illustrated at page 199, No. 39, Vol. 2, of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

639. J. MACNAB. "Improvements in telegraphing or signalling apparatus." Dated March 12, 1859.

This relates to the working of telegraphic apparatus of various kinds by a line or lines of atmospheric or hydrostatic tubes, such line of tubing being the actual means of communication between the distant points to and from which telegraphic signals are to be sent and received. The end of the tube is fitted with a cylinder and piston, by the agency of which the requisite forcing pressure can be communicated to the fluid contents of the line of pipes, whilst at the receiving stations there is a recording, and, if necessary, a printing, apparatus through which the action of the fluid movement or pressure is communicated in the form of signals. *Patent completed.*

640. R. WALLER. "Improvements in joining leather, flexible and textile materials, for the production of boots and shoes, and articles of the like description, and harness, strapping, bags, sails, tent-covers, portmanteaus, and such other articles, together with machinery and apparatus for that purpose." Dated March 14, 1859.

The patentee claims, 1, the use of sets of continuous wires or metal threads of round, square, corrugated, serrated, screwed, or milled or other shape for being cut and used as pegs in the manufacture of boots, shoes, and textile or flexible materials. 2. A method of drawing and cutting the wires for fastenings, and the manner of supplying and securing the same in the articles or materials. 3. A method of lapping or lasting the uppers of boots and shoes. 4. The use of a rivet plate for boots and shoes. 5. A method of damping and heating, pressing and moulding, the soles of boots and shoes. 6. A method of cutting, burnishing, and finishing the soles and heels, and method of fixing the same. 7. The general arrangement of machinery. *Patent completed.*

641. R. A. BROOMAN. "An improved method of treating wool and other fibres in order to form threads." (A communication.) Dated March. 14, 1859.

This consists in converting slivers or rovings as they come from a carding engine by felting and friction into threads suitable for weaving, without the intervention of any spinning machine. This is effected by an apparatus composed of a series of upper and lower cylinders which turn by frictional contact one with the other, and have at the same time a to and fro horizontal motion. *Patent completed.*

642. A. TYLOR. "Improvements in apparatus for regulating the supply of water to water-closets and other vessels." Dated March 14, 1859.

Here the supply pipe is connected to one end of the top of a chamber, in the bottom of which chamber there is a cylinder in which a piston works. To the other end of the top of the chamber a pipe is connected, and it passes to the pan of the closet. The end of the supply pipe is closed by a valve which is attached to the end of one arm of a lever; the other arm of this lever is by preference of a curved form, and passes through a slot in the piston-rod of the piston which works in the cylinder below. Through the piston there are a number of holes, and to the centre of the bottom of the piston a disc of india is attached, which, when the piston is moved downwards, prevents the passage of water through the holes, but when the piston is moved upwards permits the water to flow through freely. From the bottom of the cylinder a small pipe passes into the chamber above, and on this pipe there is a cock to regulate the speed at which water may flow through the pipes. The piston-rod of the piston passes through a stuffing-box in the top of the chamber, and is attached to the weighted lever to which the handle is ordinarily attached. By these means when the handle is lifted the piston will be moved towards the top of the cylinder, and the valve will be moved away from the end of the supply pipe. The water will then flow through the chamber into the pan until the piston is again forced down. *Patent completed.*

643. T. LIGHTFOOT. "Improvements in fixing colours on woven fabrics or fibrous materials." Dated March 14, 1859.

This consists in exposing to the action of steam cotton fabrics which have been mordaunted with salts of alumina or other earthy or metallic salts, or mixtures of salts of alumina or other salts, and subsequently dyed with madder or a preparation of madder or other colouring matters, with a view to cleaning afterwards with soap liquour, commonly called soaping. *Patent completed.*

644. D. JOY. "Improvements in hydraulic engines and meters." Dated March 14, 1859.

This applies, 1, equally to motive power engines and meters, and consists in making the working cylinder of the machine reciprocate within a chest, while the valve for induction and eduction remains stationary. The cylinder is moved at each end of the stroke either by mechanical means like a valve, or, in revolving engines, by the piston itself coming in contact with the end of the cylinder, or by other means. It applies, 2, to the ordinary form of hydraulic hoist and water engine, and consists in the use of two or more cylinders and rams working within each other telescopically, which forms a hoist of various powers, the water being admitted to any of the cylinders according to the weight to be lifted. Also in these and the ordinary form of engine when the patentee uses a slide valve, he places on the back of that valve one or more small clack valves over that part which closes the port at top as relief valves to the port when thus covered. *Patent completed.*

645. C. H. HURST. "An improved wrench or spanner." Dated March 14, 1859.

This consists in so constructing a wrench or spanner that when in use it shall not damage the article to which it is applied, and for certain articles—such as taps or cocks—it shall be self-adjusting. It also consists in making the jaws of the wrench or spanner somewhat similar in form to the article to which they are to be applied. *Patent completed.*

646. E. SMITH. "Improvements in treating or preparing furnaces used in the manufacture of iron." Dated March 14, 1859.

This relates to mill furnaces and puddling furnaces. The inventor lines the interior of mill furnaces with calcined pebbles or flints, reduced to a powder and made into a paste with water. The slag obtained from mill furnaces formed in this way is used for lining puddling furnaces. *Patent abandoned.*

647. T. PATSTONE. "Improvements in shades or glasses for gas and other lamps, and in the supports of the said shades or glasses." Dated March 14, 1859.

The patentee claims, 1, covering the upper part of the shade or glass with a dome or other shaped cover, carried by and supported upon a lining or support perforated with holes, the said lining or support carrying the cover resting either on the edge of the shade or glass, or being supported upon the top of a rod from the gas pipe or lamp stand. 2. Making the said supports or holders of glass by which the shadow of the ordinary holder is avoided, and an ornamental appearance given to the shade or glass. *Patent completed.*

648. J. S. DAWES. "A new or improved method, or combination of arrangements for the better securing and collecting of night-soil or town manure, and rendering it more valuable for agricultural purposes." Dated March 14, 1859.

This consists in so constructing closets, &c., that the excreta may be collected in movable receptacles without nuisance or any admixture of water or rubbish, and sufficiently deodorising the same by mixing with it the fine ashes and cinders produced in the house fires, or by other disinfecting agents. *Patent completed.*

649. W. LANGTON. "Improvements in the manufacture of keys and wood-fastenings used in constructing railways." Dated March 15, 1859.

Here the keys and wood fastenings are compressed and charred, and it is preferred that the keys and wood fastenings when having parallel sides should be forced through a highly heated die, formed internally to the section of the desired fastening; pieces of wood of larger dimensions than the die are in succession forced through the highly-heated die, by which they will become compressed and charred. When wood fastenings are desired to be larger at one end than the other, it is preferred to force the pieces of wood into a properly shaped and highly-heated die, and then to force the charred fastenings back out of the die, or the dies used may be, in parts, made capable of movement; or the die is used and the means of compressing and charring may be otherwise varied. *Patent completed.*

650. C. DESURMONT and C. GOUDEAU. "Certain improvements in looms for weaving." Dated March 15, 1859.

This relates to apparatus to be applied to looms for weaving figured fabrics, and has for its object the obtainment of greater speed in the action of the lames or heddles by means of a double action. It consists, 1, in the use of two presses or slides in combination with hooks and levers for raising the lames or heddles alternately. 2. In a peculiar arrangement of levers for lowering the heddles or lames. 3. In the construction and combination of a design composer, or endless tappet or rack which permits a design to be immediately formed or changed. *Patent completed.*

651. G. B. GALLOWAY. "Improvements upon and in connection with, his former patents, and in the manufacture of fuel, and working steam-engines more economically." Dated March 15, 1859.

This invention is not described apart from the drawings. *Patent completed.*

652. C. RITCHIE. "Improvements in calculating machines." Dated March 15, 1859.

This consists of a box or casing with a face plate like a dial, upon which are circles graduated for different quantities of time, money, goods, &c. Over this face-plate are two or more bands, which being suitably actuated internally point to the given and required quantities or numbers. *Patent abandoned.*

653. W. CLARK. "Improvements in the apparatus of electric lamps or lights." (A communication.) Dated March 15, 1859.

This invention is not intelligibly described apart from the drawings. *Patent completed.*

654. B. RIDER. "Improvements in hats, caps, and other coverings for the head, and in the apparatus used in the manufacture of such articles." Dated March 15, 1859.

This consists in preparing hat bodies of two thicknesses of sheet cork with a fabric of net, &c., between the two. In forming helmets of two thicknesses of felt cork-shavings or wool dust being placed between the two thicknesses of felt. In making cap peaks of several thicknesses of fabrics caused to adhere together by cement, consolidating them by hot pressure. In ironing up hat bodies with a mixture of gum dama and French chalk. In using in the manufacture of hat bodies an adhesive matter formed of saccharine matter and shellac. It also consists in coating the leather linings of hats with silk, cotton, willow, ground cork, &c., applying first a grease proof composition, which when dry is coated with adhesive matter, and the cork, &c., applied thereto. *Patent completed.*

655. J. DIXON and R. CLAYTON. "Improvements in rolling iron and steel for manufacturing railway wheels, and for other purposes." Dated March 16, 1859.

The object here is the manufacturing of railway wheels with the felloe or rim wider than the spokes or arms. The invention consists in first rolling bars that are parallel in width but of unequal thickness,

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that is to say, the part of the bar required to form the rim being thicker than the part for the spokes; the bars thus rolled are cut off to the required lengths, and then passed sideways through a pair of rolls, the action of which expands or widens the thicker part forming the rim, and leaves that part forming the spokes untouched; or if the spokes require to be tapered sideways, the rolls act slightly on the thinner parts to expand or widen them also. *Patent completed.*

656. G. SEYMOUR. "Improvements in making refined sugar, and making potash and soda from the residues." (A communication.) Dated March 16, 1859.

The inventor obtains the juice of the cane or raw sugar, or the juice or syrup from the beet root, &c., in the usual manner, which he treats with a preparation of baryta, called caustic baryta; or he treats it with the sulphuret of barium. He makes use of certain new and improved apparatus for the fabrication of such refined sugar, which apparatus, and the manner of using the same, are not described apart from the drawings. *Patent completed.*

657. W. ROBERTSON and J. G. ORCHAR. "Improvements in weaving." Dated March 16, 1859.

This relates to the "take-up motion" of looms, and consists in the use of a pike, roller, or beam studded with pointed projections or pins for taking up the cloth, the drag or quadrant uptake being applied to, or fitted up in connection with, this pike or pin roller, which apparatus can be so adjusted as to give the exact number of weft shots in the cloth that are required, whilst at the same time it provides that there shall be no take-up when the shuttle in action ceases to give off any weft. A separate and distinct roller is employed for receiving and taking on the woven cloth, so that as the studded roller to which the quadrant is applied always remains at its normal diameter, the quadrant can be trimmed or adjusted at the commencement of a piece of cloth to work steadily and evenly to the end thereof. The details of the invention are too voluminous to be quoted here. *Patent completed.*

658. C. PARKER. "Improvements in looms for weaving." Dated March 16, 1859.

This consists in a method of arranging and working looms, so that the warp threads may be slackened just prior to and during the formation of the shed, and again tightened for the beat up. *Patent abandoned.*

659. J. PARKER. "Improvements in lever-sails, and in submerged feathering-propellers." Dated March 16, 1859.

The nature of the first part of this invention consists in multiplying the power produced by the pressure of the wind by receiving the same upon direct acting lever sails, by which term is meant sails placed upon arms attached to a central shaft similar to the arms of an ordinary water wheel, so that the portions of the sails exposed to the wind (when the vessel is sailing in the wind's eye,) recede directly from the wind, the other portions of the sails being protected from the wind by a curved screen inclining to, and directing the wind upon that portion of the sails not protected by the screen. The inventor multiplies the power obtained from the central shaft, by so connecting that shaft with the driving shaft of the propeller that the latter shaft shall revolve more or less slowly than the former, according to the leverage or power desired to be obtained. The submerged feathering propeller consists of two wheels fastened to two separate shafts, placed parallel to, and at a convenient distance from each other in an air channel or trough formed in the bottom of the vessel, the ends of the shaft passing through the sides of the trough, and the wheels being so placed in the trough that their circumference projects below the trough into the water. An endless chain with paddle floats attached thereto passes round the wheels, so that the floats travel between the wheels in a straight line. *Patent abandoned.*

660. I. ASH. "Improvements in the construction of locks and latches." Dated March 16, 1859.

This invention is not described apart from the drawings. *Patent completed.*

661. F. MORDAN. "A means of keeping a stopper connected with a bottle, jar, or such like receptacle, when removed from the mouth thereof." Dated March 16, 1859.

The inventor connects a piece of elastic material to the neck of, or otherwise conveniently to, the bottle, jar, &c., and he likewise attaches it to the stopper. *Patent abandoned.*

662. H. AMBLER. "Improvements in breech-loading ordnance, and in the means of producing part or parts thereof, which improvements are also applicable to what are called small arms." Dated March 16, 1859.

The patentee forms the moveable breech of a spherical form, and of strength much in excess of that given to the barrel. The breech is bored to contain shot and powder, and the powder chamber, which is by preference in the centre of the breech, he forms larger than the bore for the shot. The bore may be grooved or rifled. The breech is at the junction, with the barrel of the gun ground to fit tightly to it, and when the gun is otherwise formed of iron, the rubbing surfaces in contact, or one of them, may be formed of brass, copper, or other metal not so liable to corrosion, and the breech is connected to the barrel by strong links with screws or other suitable means to admit of such breech turning on its axis of motion for loading, and then of being brought tight up to the gun. *Patent completed.*

663. J. FULLER. "Improvements in churns." Dated March 16, 1859.

Here a revolving axis is formed with a series of arms or beaters, which are placed around such axis, so as to succeed each other step by step, and they are each formed inclined towards their opposite edges, by which in the rotary motion of the axis the cream will be forced downwards. *Patent abandoned.*

664. W. AVERY. "Improvements in machinery for the manufacture of screws." Dated March 16, 1859.

This relates, 1, to the means of feeding the blanks into the holding clamps or jaws, whereby they are held while the head is being turned and while the thread is being cut thereon; 2, to arrangements of machinery for slotting or cutting the nick in the heads of screws, or blanks intended to form screws. *Patent completed.*

665. J. MICHEL-DENYS. "Certain improvements in the construction of railway crossings." Dated March 16, 1859.

This consists in the use of a cast-iron table or plate having lugs cast thereupon, by which it may be bolted to the ordinary wooden sleepers. Upon the top of this table are three wrought-iron crossing pieces, their upper faces being formed similar to the ordinary rail, but are made taper or conical at their lower extremity. These three crossing pieces are securely held in their places by a wrought-iron or steel plate fixed between them, being formed taper or dovetail at the edges, and secured by bolts to the top of the cast-iron table. *Patent abandoned.*

666. E. ANSCOMBE. "An apparatus for taking an accurate delineation of any view or object in open air or otherwise." Dated March 16, 1859.

This invention is not described apart from the drawings. *Patent completed.*

667. J. HARRIS, jun. "A new and useful or improved carpet sweeper." Dated March 16, 1859.

This invention is not described in detail apart from the drawings. *Patent abandoned.*

668. J. CLARK. "Improvements in the manufacture of fabrics in which compounds containing india-rubber are used." Dated March 16, 1859.

This consists, 1, in an expeditious mode of coating the surfaces of fabrics with compounds containing india-rubber, by laying on a series of coatings one on the other in immediate succession, and in the same machine. 2. In producing an endless fabric suitable for calico printers and other purposes. 3. In combining india-rubber with powdered cork and sulphur, adding when necessary india-rubber solvent, and in causing this material to be rolled or spread in sheets, or in moulding it into various shapes, and submitting it to heat to vulcanise the same. 4. In applying an endless elastic cloth or fabric to spreading or coating machines, so as to form a soft elastic bod for the fabric during its passage through the machine. 5. In combing the fibres of silk, cotton, wool, flax, &c., with woven, felted or other fabrics, so as to produce in a continuous manner combined fabric of great use and ornament. 6. In vulcanising the fabric known as "Clark's Patent Felt" by combining sulphur with he india-rubber composition used in the manufacture of the patent felt, and submitting the patent felt to the action of heat to effect the vulcanising process. *Patent completed.*

669. G. HAMILTON and W. H. NASH. "Improvements in tumbler or lever locks, and in keys for such and other locks." Dated March 16, 1859.

To avoid the use of springs for disengaging the tumblers or levers after the bolt of the lock has been shot, a projection is formed in the plate attached to the bolt, and this projection, after the bolt has been moved sufficiently to free the tumblers or levers, is, by the further movement of the bolt, caused to strike against one tooth of a cogged wheel with three teeth, or a triangular or other suitably shaped piece, which turns on centres at its two ends. This piece is thus made partially to revolve, and in revolving, one of its edges or angles strikes against projections on the tumblers or levers, and disarranges them, and when the bolt is drawn back another projection on the plate attached to the bolt moves the rotating piece into a suitable position for its being again acted on (when the bolt is again shot forward) by the first-mentioned projection in the plate attached to the bolt. It also consists in so constructing tumbler or lever locks that the key when turned shall first act on the levers or tumblers so as to arrange them suitably for the bolt to be shot, and that after the bolt has been shot the key shall again act on the levers or tumblers so as to disarrange them before the key can be withdrawn from the lock. The whole length of the stem of the key is hollow. *Patent abandoned.*

670. H. BESSEMER. "Improvements in the manufacture of crank axles." Dated March 16, 1859.

The patentee claims, 1, the manner of forming locomotive and other crank axles from a plain slab, or rolled, or hammered ingot of cast malleable iron, cast-steel, or cast semi-steel, by sawing or otherwise cutting away such parts of the mass as will leave a piece of metal having the general form of the intended crank axle. 2. The use of circular or other saws for shaping a mass, or for cutting away the superfluous portions from a mass of cast malleable iron, cast-steel or steel, or cast semi-steel, while the same is in a heated state, in order to obtain from the mass of metal so cut or shaped a locomotive or other crank axle. 3. In the manufacture of locomotive and other crank axles made of cast malleable iron, or cast-steel, or cast semi-steel, the twisting of the axle so as to alter the angle of the different throws from the common plane in which they are formed into any desired angle or relative position to each. *Patent completed.*

671. T. W. MILLER. "Improvements in blocking or securing ships and other vessels whilst being removed, examined, or repaired." Dated March 16, 1859.

This relates to the application of hydraulic or hydrostatic power or fluid pressure employed in a series of presses or cylinders and rams fitted upon the moveable cradles or platforms of hauling up ships or shipways; or to pontoons, rafts, floating or dry docks, the ram-heads or piston-heads of which may be fitted with beams, cross-heads, or vibrating arms or levers capable of adjustment to the form or angle of the ship's side or bottom, and such arms may be filled with friction rollers, or be so formed as to act as buffers. *Patent completed.*

672. C. DEBRIES. "Improvements in lamps." Dated March 17, 1859.

This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated July 26, 1859.

1739. D. B. Hale. A new and useful garment for ladies' wear, being a combined waist or body and a skirt supporter and bustle. (Partly a communication.)

Dated Sept. 5, 1859.

2024. J. B. H. H. R. Barre and J. B. M. E. Barre. Improvements in cutting out or engraving metals and their alloys.

Dated Sept. 9, 1859.

2058. M. M. Jackson. Improvements in generating steam for condensing engines.

Dated Sept. 13, 1859.

2086. E. A. F. Lebourgeois. An improved machine for providing with pin points the blocks employed for surface printing on calico, paper, or other similar materials.

2088. A. B. Freeland. Improvements in preparing hay and clover for food for horses and other animals.

Dated Sept. 14, 1859.

2092. J. Marritt. An improved double-action rotating harrow.

2094. R. C. Rapier. Improvements in the construction of steam boilers.

2096. N. Defries. Improvements in gas meters.

2098. A. Applegath. Improvements in machinery for printing and for cutting printed paper into sheets.

Dated Sept. 15, 1859.

2100. J. Addenbrooke. An apparatus for wrapping, folding, or packing up goods or parcels.

2102. J. T. Wood. Improvements in printing and embossing dies.

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2104. J. P. Clarke. Improvements in the manufacture of spools or reels for the winding on of cotton, linen, thread, silk, or other fibrous materials.

Dated Sept. 16, 1859.

2106. J. Bottomley and A. H. Martin. Improvements in means or apparatus employed in weaving.
2108. B. Lauth. Improvements in the manufacture of rails for railways.
2112. J. Beck. Improvements in stereoscopes.

Dated Sept. 17, 1859.

2114. J. Luis. Improvements in mechanical hammers. (A communication.)
2116. J. Luis. An automaton bell for the prevention of collisions at sea. (A communication.)
2118. J. Luis. Improvements in cooling apparatus for liquids, especially beer. (A communication.)
2120. J. J. Kerr. Improvements in the manufacture of cartridges containing shot.

Dated Sept. 19, 1859.

2124. E. H. Taylor. Improvements in the mode of securing the bolts in fish joint and other fastenings for rails on railways.
2126. J. Hawkins and C. Hawkins. Improvements in fly presses to be worked by steam, water, or other power.
2128. R. McCall. Improvements in obtaining precipitates of copper, parts of which improvements are applicable to the production of yellow ochre.
2130. T. C. Eastwood. Improvements in means or apparatus for preparing and combing wool, cotton, and other fibres.
2134. W. Clark. Certain improvements in electro-magnetic telegraphs. (A communication.)
2136. J. Court. Improvements applicable to gas and other lamps and lights, and also gas stoves for effecting more complete combustion therein.

Dated Sept. 20, 1859.

2140. W. McIlwraith. Improvements in weaving.
2142. A. Lamb. An improved method of heating the feed water for boilers.

Dated Sept. 22, 1859.

2155. T. Field. A new means and system for cleaning, ironing, pressing, and glazing women's stays, corsets, supporting bands, men's jackets, coats, trousers, and waistcoats, chintzs, laundry work (that is to say, goods and articles generally washed by laundresses), window blinds and textile fabrics generally.
2157. J. Dales. Improvements in purifying sewage and other impure waters, and in separating therefrom materials suitable for use as manure, and also the preparation of a substance to be employed for such purposes.

Dated Sept. 23, 1859.

2159. L. Castelain and C. F. Vasserot. A novel application of a plant to the manufacture of pulp for paper and millboard, and in the method of treating the same when so applied.
2161. C. J. Parry. Improvements in diamond shirt fronts.

Dated Sept. 24, 1859.

2163. J. J. Bourcart. Improvements in machinery or apparatus for opening, cleaning, carding, and drawing cotton, and other fibrous materials.
2165. A. R. Normandy. Improvements in the application of steam for cooking food.
2167. C. Lambert. Improvements in machines or apparatus for cutting and pulping food for cattle, and for other like purposes.
2169. T. Robinson. Improvements in steam hammers.
2171. J. T. Pope. Improvements in the manufacture of marbles.
2173. J. Opie. Improvements in instruments or apparatus for charging holes in blasting operations, parts of which are also applicable for like purposes.

Dated Sept. 26, 1859.

2175. R. W. Sievier. Improvements in the means of creating a draught, so as to remove the gases which may be produced by combustion, or from places where gases may be generated where they may be detrimental to health.
2177. D. White. Increasing the illuminating and heating powers of gases, and regulating the flow of gases, and improvement in the material for gas meters, and improvement in glass and cylinder holders.
2179. J. Villet-Collignon and L. George. Improvements in the typography.

Dated Sept. 27, 1859.

2181. W. Airey and J. Clayton. Improvements in machinery or apparatus for preparing silk, wool, cotton, flax, or other fibrous substances for spinning.
2183. T. Birtwell and R. Marshall. An improved arrangement of apparatus to facilitate the putting on of boots to the feet.
2185. J. S. Parfitt. An improved machine for heading bolts, rivets, screws, and other similar articles requiring to be headed whilst hot.
2187. T. Beards. Improvements in ploughing and cultivating land by steam power, and in machinery used for such purposes.

Dated Sept. 28, 1859.

2198. W. Maltby. An improved mode of producing starch-gum.
2191. E. K. Dutton. Certain improvements in "governors," particularly adapted to steam-engines.
2193. T. Sutton. Improvements in the construction of apparatus for taking photographic pictures, consisting of and entitled, "an improved panoramic lens for taking photographic pictures."
2195. W. H. Phillips. Improvements in apparatus for generating and regulating heat, applicable to culinary and other purposes.
2197. G. Evans and E. Huxley. Improvements in the construction of hernial trusses and pads adapted to surgical purposes generally.
2199. M. L. J. Lavater. Improvements in apparatus known as injection bottles, and in pneumatic discs used in apparatus for adhering to glass and other impermeable substances.
2201. D. Stewart. Improvements in presses used for pressing goods.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Oct.* 11, 1859.)

1323. J. Bapty. Felted cloth.
1325. A. Smith. Ropes and cables.
1326. W. Grimshaw. Compressing bricks, &c.
1330. J. Fry. Mills.
1339. W. Smith. Raising and docking ships. (A communication.)
1340. J. S. Cockings. Cartridge-carriers.
1343. J. Wansbrough. Stereoscopes. (A communication.)
1349. J. F. Miquel. Trusses.
1354. S. and J. Wood and P. Billington. Embroidering.
1366. H. N. Penrice. Propelling vessels.
1370. A. R. Arrott. Soda.
1371. J. Burrow and W. N. Wilson. Floor scrubber.
1377. G. Davies. Wearing apparel. (A communication.)
1384. W. Green. Mowing machines.
1385. C. Pooley. Spinning.
1388. W. B. Nation. Superphosphate of lime.
1404. J. H. Tuck. Breakwaters, &c.
1405. E. Welsford. Tanning.
1423. H. L. Corlett. Permanent way.
1438. E. Humphrys. Steam engines.
1445. W. Birkmyre. Preparing yarns.
1450. T. W. Jones. Stereoscope glasses.
1456. T. Cattell. Varnish and lacker.
1474. W. Clark. Supplying furnaces with hot air. (A communication.)
1483. A. V. Newton. Steam boilers.
1491. W. E. Newton. Shears. (A communication.)
1551. J. J. Griffin. Gas furnaces.
1577. M. Bogg. Washing machines.
1773. P. M. Parsons. Switches and crossings.
1847. W. MacLellan. Permanent way. (A communication).
1928. W. Hollins and F. Hyde. Looms.
1978. J. Cowgill and J. Stocks. Spinning.
1981. R. Beverley. Wet gas meters.
2092. J. Marritt. Harrow.
2106. J. Bottomley and A. H. Martin. Weaving.
2129. J. Wright. Carriages. (A communication.)
2140. W. McIlwraith. Weaving.
2193. T. Sutton. Panoramic lens.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Oct. 7, 1859.

866. A. Chaplin.
876. W. Campion.
877. M. Wheeldon.
879. M. A. F. Mennons.
881. W. Hooper.
882. W. Hooper.
888. T. Barnett, H. T Sourbuts, and W. Loynd.
890. J. Hawkins.
893. J. Martin.
905. W. Rowan.
906. R. A. Brooman.
907. W. S. Clark.
909. J. Marland.
912. P. Aitchison.
918. M. Castay.
921. R. A. Brooman.
922. S. Tatton.
923. R. Emery.
928. W. Craft and T. Wilson.
929. A. R. Johnson.
930. J. A. Coffey.
932. J. L. Stevens.
933. J. Hughes, W. Williams, and G. Leyshon.
946. G. Abeillou.
952. H. Barrow.
956. W. Clark.
967. J. Luis.
1045. W. E. Newton.
1050. J. H. Johnson.
1007. R. Harrington.
1120. J. G. Willans.
1204. W. S. Thomson.
1270. F. J. Bramwell.
1297. C. E. Amos.
1318. T. Wilson.
1412. W. Sellers.
1552. G. Baker.
1572. E A. Wood and M. D. Rogers.
1592. A. V. Newton.
1597. W. E. Newton.
1843. J. D. Bryant.
1872. J. and W. Stuart.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2206. W. Smith and N. F. Taylor.
2352. F. Whitehead.
2358. D. Joy and W. Holt.
2364. T. King.
2371. L. J. Jordan.
2380. W. Rennie, jun.
2389. G. W. Varnell.
2414. G. Collier.
2446. J. F. Deshayes.
2456. J. Lacassagne and R. Thiers.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

234. J., W., and T. Balmforth.
280. W. Bissell.
282. J. Blair.
292. S. Rainbird.
324. T. Restell.
330. H. Moorhouse.
400. S. Pincoffs and H. E. Schunck.
413. C. T. Judkins.
448. J. Otams.
545. C. B. Normand.
565. W. H. F. Talbot.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Oct. 8, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
574	0 3	581	0 3	586	0 10	591	0 3	596	0 7	...	...
576	0 6	582	1 4	587	0 3	592	1 1	597	0 3	...	...
577	0 7	583	0 3	588	1 10	593	0 3	598	0 6	...	...
578	0 9	584	1 4	589	0 3	594	0 4	599	0 3	...	...
580	0 6	585	0 3	590	0 3	595	0 9	600	0 3	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

PRICES CURRENT OF METALS.

London, Oct. 14*th*, 1859.

		£ s. d.		£ s. d.	Dis.
IRON:					
Rails in Wales and North of England	pr. ton	6 0 0	to	0 0 0	nett
Welsh Bars, in Wales	"	5 17 6	"	6 0 0	2½
Staf. Bars, at the Works	"	7 0 0	"	7 10 0	2½
" Hoops	"	8 0 0	"	8 10 0	"
" Sheets, Singles	"	8 10 0	"	9 0 0	"
" Nail Rods	"	7 0 0	"	7 10 0	"
" Boiler Plates	"	8 10 0	"	9 0 0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2 11 9	"	2 12 0	nett
Do. No 1, Good Brands	"	2 12 3	"	2 14 6	"
Scotch Bars	"	7 10 0	"	8 0 0	
Swedish Bars, in London	"	11 10 0	"	11 15 0	
COPPER:					
Sheet and Sheathing	per lb.	0 0 12	"	0 0 0	
Tough Cake and Tile	pr. ton	107 10 0	"	0 0 0	
Best Selected	"	110 10 0	"	0 0 0	"
Australian	"	110 0 0	"	0 0 0	"
South American	"	100 0 0	"	0 0 0	"
Yellow Metal Sheathing	per lb.	0 0 10	"	0 0 0	"
STEEL:					
Swedish Keg	pr. ton	19 0 0	"	19 5 0	2½
" Faggot	"	21 0 0	"	21 10 0	"
TIN:					
English, Block	p. cwt.	6 16 0	"	0 0 0	3½
" Bar	"	6 17 0	"	0 0 0	"
Foreign, Banca	"	7 2 0	"	7 3 0	nett
" Straits	"	6 17 0	"	6 12 0	"
TINPLATES:					
Charcoal, I.C.	pr. box	1 12 0	"	0 0 0	3
Coke, I.C.	"	1 6 0	"	0 0 0	"
LEAD:					
Pig, English	pr. ton	22 5 0	"	22 10 0	2½
" Spanish	"	21 10 0	"	22 5 0	"
Sheet	"	23 0 0	"	23 5 0	"
SPELTER:					
On the spot	"	20 15 0	"	21 0 0	nett
For arrival	"	20 15 0	"	21 0 0	"
ZINC:					
English Sheet	"	27 0 0	"	0 0 0	1½
QUICKSILVER	pr. btl.	7 0 0	"	0 0 0	1½

REMARKS.—We continue to have a very sluggish market for all kinds of Metals, and little alteration in price. Scotch Pig-iron has slightly improved under a threatened strike among the colliers near Glasgow. In Spelter there has been a slight improvement.

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 21, 1859.

ROBERT STEPHENSON.

Robert Stephenson is dead. He died on Wednesday, October the 12th. We saw him last in the House of Commons a few days before the prorogation. He then seemed to be in good health, and we had no intimation that his health had failed until a paragraph in the morning papers startled us with the painful intelligence that he was hopelessly ill. Mr. Stephenson's age was 56, and from his appearance we judged that he might live at least another dozen years; but Mr. Stephenson has lived every day of his life. He worked very hard when he was a boy, and when he came to man's estate he entered upon a career of mental and bodily labour which very few have been called to endure; and all this, together with exposure by land and by sea, in all sorts of climates, was no doubt the cause of his premature death. The laws of nature are inexorable; drive the machine fast, and it will do more work in a given time than if it were driven slowly, but it will wear out sooner.

Mr. Robert Stephenson's family boasts not of ancient descent, nor of heraldic honours. Mr. Smiles, the biographer of George Stephenson, traces it back no further than the grandfather of Robert, who was a humble labourer, and nothing more. This grandfather, Robert Stephenson, married Mabel, the daughter of Robert Carr, dyer, at Ovington, by whom he had six children, the second of which was George Stephenson, the great engineer, and father of Robert, just deceased. Both grandfather and grandmother, though "they had very little to come "and go upon," but "were sore haudden doon "in the world," had, however, the reputation of being "very honest folk;" and there was evidently some faculty in the grandfather, for he was "a curious lover of nature, and very "fond of romantic stories;" and it is recorded by Mr. Smiles that he would often draw round his engine fire the young people of the neighbourhood and relate to them the wonderful history of Sinbad the Sailor, and other stories drawn from his own imagination. George Stephenson entered the world under circumstances as discouraging to all hopes of rising as could well be imagined. His parents were far too poor to send him to school, and therefore in his earliest days he used to run wild about the roads, go birds'-nesting, run errands, or keep the younger children out of the way of coal-waggons. At eight years old he was set to work as a cow-boy at twopence a-day wages; afterwards he was promoted to lead horses at plough; then he was set to turnip hoeing, and at length he got to the topmost height of his childish ambition, by obtaining employment in a colliery; and subsequently, when it was announced to him that he was to have 12s. per week, so low then were his aims, and so little did he dream of the glorious career which was before him, that he exclaimed triumphantly to his fellow-workmen, "There, now, I am a made man for life." At this time he could not read or write. He did not attain to the accomplishment of reading until he was eighteen years old, and it was not till a year afterwards that he could write his own name. When he was twenty he rose to be "brakesman" at Dolly Pit Colliery, Black Callerton; his earnings then were 20s. a-week. At twenty-one he boldly took a wife. He had for some time before contemplated this step, and to prepare for it had employed his leisure hours in extra work. His principal employment was to make and mend shoes, an art which he had learned, as he learned everything that he knew during his life, without formal instruction. His wife was Fanny Henderson, a servant in a neighbouring farmhouse. The marriage took place on the 28th of Nov., 1802; on the 16th December, 1803, Robert Stephenson was born, and in the following year the mother died.

It was a mad world when Robert Stephenson stepped into it. A more frightful epoch of its history England has scarcely ever known. We had just declared war with France; there was also war in India; bread was frightfully dear; every seventh person in the kingdom was a pauper; there was an income-tax of five per cent., soon to be raised to ten; and within a few years of Robert Stephenson's birth the country from one end to another was an armed camp. In 1805 the gross forces of the United Kingdom amounted to 700,000 men, and in 1808, 200,000 local militia were added. All this bore heavily upon all classes, and George Stephenson did not escape, for in addition to the common burdens of taxation, and the dearness of food which he had to bear, he was drawn for the militia, and had to decide whether he should serve or find a substitute. He chose the latter alternative, but the penalty was the sweeping away of nearly all his hard-earned savings. This was a terrible blow, and he felt it so severely that he "wept bitterly," and made up his mind to emigrate to America. Happily, however, for England and himself, he was obliged to give up the project, for he had no money. George Stephenson was not, however, the man to sit down in despair: having indulged his sorrow, he boldly confronted his circumstances like a brave man, and speedily conquered. About this time he went to Scotland to superintend the working of an engine at Montrose Colliery. Here he received good wages, and he returned with £28 in his pocket. During his absence his father had met with an accident and was now blind; whereupon on his return George cleared off the old man's debts, amounting to £15, placed him in a comfortable cottage, and kept him for the remainder of his life. We mention this fact for two reasons—first, to illustrate the character of Robert's father, and, secondly, to present a pretty picture. Old Mr. Stephenson, the grandfather, was very fond of his grandson, and one of his greatest pleasures was, we are told, to have a visit from his grandson Robert, who would ride straight into the cottage on his "cuddy" (*Anglicè* donkey) and call upon his grandfather to admire its points, and would dilate upon its ears, fetlocks, &c., and generally finish by declaring that it was a "real blood."

Some philosophers assert that uneducated people cannot appreciate education sufficiently to strive to obtain it for their children; and, as a rule, this may be true; but if so, George Stephenson was an exception to the rule, for, from the time of his son's birth, he made up his mind that he should go to school. How he accomplished this is best told in his own words. Many years later in his life, he said:—"In the "earlier part of my career, when Robert was a "little boy, I saw how deficient I was in educa- "tion, and I made up my mind that he should "not labour under the same defect, but that I "would put him to a good school, and give him "a liberal training. I was, however, a poor man; "and how do you think I managed? I betook "myself to mending my neighbours' clocks and "watches at night after my daily labour was "done; and thus I procured the means of edu- "cating my son." And so Robert was sent to school. First he went to "a road-side school," kept by "Rutter, the parish clerk," where he learned his primer, and how to make "strokes and pot-hooks." And afterwards, in 1814, when his father had risen somewhat in the world, and could afford it, he was transferred to Bruce's Academy at Newcastle; and subsequently entered as a member of the Newcastle Literary and Philosophical Institution, the annual subscription to which was £3 3s. Nor was this all, for, as we shall see, an education at home went on *pari passu* with that at school. Some of the books of the Institution were allowed to be taken away by the members; and, on Saturday afternoon, when Robert went home to his father's, he used to take books with him, and read them to his father, when father and son would enter into lively discussions, wherefrom both gained instruction. But some books were not removeable; and from them the son was instructed to make extracts for his father's information; and his father, who had got on rapidly with his self-culture, would practice his son in reading off plans and drawings of machinery. And thus did Robert Stephenson's education go on; and with what effect, let the following incident recorded in Smiles's "Biography of George Stephenson" show:—The son, like the father, was very fond of reducing his scientific knowledge to practice. On one occasion, after reading Franklin's description of the lightning experiments, he expended all his hoarded Saturday's pennies in purchasing half a mile of copper wire. After privily preparing a kite, he sent it up at the cottage door, fastening the wire to the palings, near which his father's pony was standing waiting for his master to mount; and, bringing the end of the wire just over the pony's crupper, so smart an electric shock was given to the animal that he was nearly knocked down. At this juncture his father issued from the door, whip in hand, and was witness to the scientific trick which had been played upon his galloway. "Ah, you mischievous scoundrel!" cried he, and the boy ran off. But George Stephenson could not help inwardly chuckling with pride, nevertheless, at his son's successful experiment. At a subsequent period, Robert brought home "Ferguson's Astronomy;" and, under his father's direction, drew out on paper a sun-dial suitable for the latitude of the place; and, a stone having been procured, after much thought and labour, the dial was fixed over the cottage door, to the great wonderment of the villagers; and there it stands now.

Robert Stephenson stopped at Bruce's Academy four years; and, on leaving it in 1818, he was apprenticed to Nicholas Wood, at Killingworth, to learn the business of a colliery; for at that time George Stephenson had no higher views for his son than that he should get a situation in a colliery. Robert served in the capacity of under-viewer for three years, and thus became familiar with all the departments of underground work. This occupation was not unattended with danger; and, on one occasion, Robert Stephenson's career was very nearly being abruptly closed. It appears that Mr. Wood, Robert, and a man named Moodie were proceeding along one of the galleries. Robert had a "Geordie lamp" (a safety lamp invented by his father), and Wood a naked candle in his hand. When they were at the further end of the gallery, an explosion of fire-damp took place; and instantly the whole party were blown down, and the lights extinguished. They were a mile from the shaft, and quite in the dark. Robert and Moodie at the first impulse ran back; but they had not gone far, when Moodie halted, and cried out, "Stop, laddie, we maun gang back, and seek the maister!" So they went back. Happily no further explosion had taken place,

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and they found "the maister" stunned, bruised, and burnt, but not dangerously injured. The time spent at the colliery was of the utmost benefit to both father and son. The evenings were generally devoted to reading and study; the two working together as co-labourers and friends. They entered into eager discussions, principally on the comparatively unknown powers of the locomotive, on which George Stephenson had already begun to reflect, and about which the son was even more enthusiastic than the father. Robert would suggest alterations, his father would offer every possible objection, proud, nevertheless, of his son's suggestions, and often warmed and excited by his son's brilliant anticipations of the ultimate triumph of the locomotive.

These discussions probably had a considerable influence in inducing Mr. Stephenson to take another step in the education of his son. The lad was only seventeen, and was doing well, and would certainly rise in his profession; but the father was not contented. He saw his own deficiencies; and probably grand ideas were looming before him relative to railroads and the powers of the locomotive, to realise which he felt that he should require more knowledge than he possessed; and he determined to give his son the best education in technical science which his means would allow; and thus secure a hearty, efficient, and generous co-worker in the elaboration of his ideas. He accordingly took Robert away from his labours in the pit in the year 1820, and sent him to the University of Edinburgh. This was a bold step, and expensive; but the father had no reason to repent it. Robert Stephenson was at Edinburgh only six months; but his mind was so prepared for the reception of knowledge that it is not too much to say that he did more in six months than many do in three years. The expense was £80; but when, at the end of the term, Robert returned with the mathematical prize, George Stephenson felt that, serious as the sum was to him then, he was more than repaid.

When Robert Stephenson returned to his home he was articled to his father, who had already commenced manufacturing locomotives; and in 1824 we hear of him making designs for fixed engines for the Brusselton incline on the Stockton and Darlington line, then in progress. But whilst employed in the factory the health of the young engineer failed, and with the consent and encouragement of his father he took an appointment as investigator and superintendent of some silver mines in South America, whither he went in 1824. It was just before Robert embarked that his father uttered his memorable prophecy about railways: "Now, my lads," said he to his son and John Dixon as they all sat at the dinner-table, "I will tell you that I think you will live to "see the day, though I may not live so long, "when railroads will supersede almost all other "modes of conveyance in the country—when "mail coaches will go by railway, and railroads "will become the great highway for the king "and all his subjects. The time is coming "when it will be cheaper for a working man to "travel on a railway than to walk on foot," &c. This was a bold prophecy at the time; but it was soon fulfilled, and the prophet lived to see its fulfilment.

Whilst Robert Stephenson was absent his father stepped on at a gigantic pace. The Stockton and Darlington railway was made by him and opened; the Newcastle factory, begun in 1823, had been got thoroughly into work; he had surveyed the line from Manchester to Liverpool; he had fought those tremendous battles in the Parliamentary Committee Rooms with lawyers and engineers, and, almost single-handed, had utterly routed his opponents; and having been appointed engineer of the Liverpool and Manchester line at a salary of £1,000 a-year, had commenced the works. And now, wanting help, he summoned home his son. Him he knew—him he could trust to stand by him. Robert obeyed the summons immediately, speedily arrived in England, and at once placed himself at the head of the factory, and took that burden off his father's shoulders.

And now came one of the epochs in the career of the Stephensons, and in the history of railways. During the construction of the Liverpool and Manchester line, a great battle raged upon the question whether stationary engines or locomotives should be employed in working the line. Most of the great engineers of the day, Walker, Telford, Rastrick, Tredgold, and others were against, or looked coldly upon, locomotives. George Stephenson, "aided by "his son" and Mr. Locke, stood manfully his ground. The Directors, bewildered by the contrarieties of opinion expressed in the reports and rejoinders, but secretly all the while inclining to locomotives, at last hit upon the expedient of offering a prize of £500 for a locomotive that should prove itself capable of doing what was required. This was one of the turning points of the Stephensons' fame and fortune. Mr. Stephenson immediately set about the construction of his trial locomotive, the far-famed Rocket. It was erected under the immediate superintendence of his enthusiastic son. On the day of trial it was the first to be placed on the road, and not only beat all its opponents but established for ever that locomotives only were fit for railways; raised the Stephensons to the highest pitch of fame; and opened up before the astonished gaze of mankind a vista of social revolution, the end of which men of the sharpest vision were not able to discover.

Robert Stephenson was now fairly in his career, and for some years afterwards we find the names of father and son associated together in almost all the great works of the day, until gradually the father glides off the stage and leaves it to his son. In 1830 George Stephenson was appointed, in conjunction with his son, engineer-in-chief to the London and Birmingham line. But Robert took the management of this great work; he surveyed the line and prepared the plans for Parliament. In the course of this survey it is recorded that he walked over the whole distance upwards of twenty times. He also superintended the making of the line, and when in the formation of the Kilsby tunnel that hidden quicksand was discovered which was so nigh proving fatal to the work (and did prove fatal to the contractor, for he went home, took to his bed, and died), Robert Stephenson rushed to the rescue, and when all besides despaired, despaired not. The directors were for abandoning the work; but Robert Stephenson begged for another fortnight. It was granted; and at the end of that short time he had showed that he could conquer, and by the strength of 1,250 men, 200 horses, and 13 steam engines pumping night and day for eight months, and raising the almost incredible quantity of 1,800 gallons of water per minute, he emptied the tunnel and then completed the work. Robert Stephenson was also engaged as engineer to the Leicester and Warrington line; and here his scientific knowledge came into play, and he was enabled to repay his father a hundredfold for all that his education had cost. There was an estate close to the line the lease of which was for sale. This estate attracted Robert Stephenson's attention. He examined it, and decided that there was coal beneath its surface. He reported to his father, who, after examination, bought the lease, and borings were commenced. It was then discovered that experiments had already been made by others, but without success. Nothing dismayed at this, however, Robert Stephenson went on boring. At last the trap rock was reached, but still the boring was continued, and after awhile, to the astonishment of former experimenters, the rock was perforated and coal found beneath—*the trap rock had overlapped the coal stratum.* We cannot notice at length all the works of this eminent man, nor is it necessary that we should do so. The early part of a great man's career is generally the most interesting, and least known. We felt that this was true relative to Robert Stephenson, and therefore we have given more space to his early life, and now can do little more than mention some of his greatest works. Newcastle owes to him its wonderful high-level bridge, which has been called "the king of railway structures." The Tubular Bridge over the Menai Straits is also his. This is erected on an entirely novel principle. Daring in the extreme it appears, and by some, when projected, it was pronounced to be chimerical. But Robert Stephenson was never chimerical. All his projects were adopted after much thought and experiment, and were based upon sound principles. Science, it has been said, teaches us what it is impossible to do; Robert Stephenson was well grounded in the science of his art, and though prepared to go to the limits of the possible, never attempted the impossible, and hence his invariable success. He also threw a bridge of the same sort over the Conway, another over the Damietta branch of the Nile, and when he died he had nearly completed an enormous structure on the same principle, nearly two miles long, over the St. Lawrence, in Canada. The problem which he had to solve before he commenced this his greatest work was a most remarkable one. From the Lachine Falls to Montreal is nine miles, and the question first to be considered was, what is the pressure of nine miles of ice four or five feet thick in a running stream of a certain velocity and breadth? And, this being ascertained, what sort of piers would withstand this pressure? These two problems our engineer has solved, for he has built a bridge that, during the four years which it has taken to build it, has been repeatedly subjected to the pressure of the ice, and has remained immovable. But we must hasten to a close. It is impossible to enumerate the works which have proceeded from the creative mind of Robert Stephenson. Suffice it to say that he has left his mark in almost every country of the civilised globe.

Robert Stephenson was Member of Parliament for Whitby. He was first returned for this borough in 1847, the year before his father died, and has only once been opposed. In politics he was a moderate Conservative. He did not often speak in the House, and when he did it was always on matters connected with his profession. About two years ago we remember that he addressed the House with great effect. There was an attempt made at a move in favour of the Suez canal project, and, of course, a good deal of nonsense was uttered; for what could the talkers know about the matter? At last Mr. Robert Stephenson rose, and the House, which just before had been all in a buzz, was now silent as a church, and every eye was turned upon the speaker; and it was amusing to note how, with a few pregnant words, he smashed the bubble. "About the political "part of the subject I say nothing—but I "think I know something about the profes-"sional part. I have heard a good deal about "the fall between the two seas: well, I have

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"surveyed the line; I have travelled the whole "distance on foot, and I declare there is no "fall. Honourable members talk about a canal. "A canal is impossible—the thing would be a "ditch." This was the substance of his speech; and after this, of course, there was nothing to be said—"for what can the man do that cometh "after the king?" Mr. Stephenson spoke also last session with equal effect on the subject of cleansing the Serpentine. Mr. Stephenson was, of course, no orator. He never professed to be a talker: his business lay quite another way; but he could speak calmly and without hesitation, and his speeches were always marked by that clearness which indicates that the speaker understands his subject.

It is the universal testimony of all who had transactions with him that Robert Stephenson was an upright man. The career of "railway men" is a fiery ordeal, and few come out of it without scathe; but Robert Stephenson has left no "damned spot" upon his reputation for enemies maliciously to point at and friends to attempt anxiously to conceal. And he was generous as he was just. "His benevolence "was unbounded," says the *Times*, "and every "year he expended thousands in doing good un-"seen. His chief care in this way was the "children of old friends who had been kind to "him in early life, sending them to the best "schools, and providing for them with charac-"teristic generosity." Mr. Stephenson married in 1829 Frances, daughter of John Sanderson, merchant, London; she died in 1842. Mr. Stephenson was not again married, and he has left no children.

Mr. Robert Stephenson has received not a few marks of distinction. He was decorated with the Belgian Cross of Honour by King Leopold; in Norway he received the Grand Cross of St. Olaff; in France the Emperor, at the Exhibition of 1855, presented him with the decoration of the Legion of Honour; and Oxford, in 1857, made him a D.C.L., &c., &c. But we do not think Robert Stephenson or his father cared much for these gauds. A French lecturer said that honours were offered to Robert Stephenson by the English Government, and refused. We suppose they wanted to make him a knight. Foreigners have expressed their astonishment that Robert Stephenson was not elevated to the peerage; but foreigners do not understand English customs. We make peers of intriguing politicians, discontented statesmen, successful lawyers and generals, but if we had made a peer of Robert Stephenson, all Belgravia would have turned pale.

One reflection, and we close. Fifty-five years ago George Stephenson was a poor labourer, and Robert was lying in his cradle, while his father was cobbling shoes by his side. Then the stage coach dragged along at about six miles an hour, footpads still prowled on Hounslow Heath and Finchley Common, and a letter posted in London would reach Edinburgh perhaps in the course of a week: now we can get from London to Elinburgh in less than twelve hours, and a letter posted in the English metropolis at six p.m. is on the breakfast table of the Edinburgh merchant on the following morning; and this change has been mainly brought about by George Stephenson and his illustrious son. There are, we believe, no public monuments to these men—nor do they need any. Of each it may be said, *si monumentum queris circumspice.*

Ere these remarks are read many of England's elect will have assembled at the tomb of Robert Stephenson and rendered their last act of homage to one of our noblest men.

It is but justice to say, that we are, to a very great extent, indebted for the materials of this sketch to Mr. Smiles's admirable volume.

THE ADMIRALTY COMMITTEE ON DOCKYARD ECONOMY.

Two months have elapsed since we gave to our readers the essence of the Report made by this Committee, and drew forth Mr. Murray's refined letter of rebuke. The blue book containing the Report is now before us, the order for printing it having been given by the House of Commons, curiously enough, on the very day that our abstract of it was put in type. As we succeeded in producing it so many weeks before the public could otherwise have had access to it, we can only regret that it should have been of such little value. It nevertheless has some claims upon our attention which must not be neglected.

In the blue book before us we have first the Report itself; then follows Mr. Chatfield's letter of dissent, and its accompanying explanations; then a reply to these by Messrs. Murray, Laws, and Bowman, and a counter reply by Mr. Chatfield; then remarks upon the whole by the Surveyor of the Navy—promises of future remarks by the Accountant-General and the Storekeeper-General of the Navy—and, finally, a reply to the Committee by Colonel Greene on the New Works Department. Most of these papers contain matters of interest, but before we enter upon their discussion we must mention the disgraceful manner in which this volume is put before the public. In the first place we find that from the table of contents with which it is prefaced no less than 90 of the 208 pages composing it are omitted altogether—nearly one-half of it. We know not who is responsible for this, but we are inclined to suspect that some sinister influence has had to do with it, inasmuch as the whole of Mr. Chatfield's crushing rejoinder to the Report is among the matter missing from the contents. The Report itself, containing only 93 pages, has more than *a page and a half* devoted to its contents, while all the remaining portion of the volume is dismissed with *four half-lines!* The consequence is, it is impossible to refer to the papers furnished by Sir Baldwin Walker, Mr. Chatfield, and Colonel Greene without great difficulty and trouble. In addition to this, it should be observed that Mr. Chatfield's remarks have been split up in a most confusing manner. His first paper is cloven clean in two by a letter from another gentleman, and the signature of the second portion of it is thrust in unnoticeably at the end of a table.

The first thing that strikes us on looking into the rejoinders made to the Report is, that the Surveyor of the Navy has not taken much trouble in replying to Mr. Murray. He seems to be quite content to adopt both the spirit and the substance of Mr. Chatfield's observations, and to leave his defence as that gentleman has placed it. He does not omit, however, to convey in pretty plain terms his estimate of the Committee and its designs. He tells us that he is quite aware that the object of the Committee was to get the public service assimilated to the practices of private trade, but adds that the dockyard system has been adopted deliberately, and "has stood the test of repeated and "searching inquiries by Commissioners and "Committees composed of men whose ability to "conduct such inquiries cannot be questioned" —which is far from being the case in the present instance, being the reflection that naturally follows, of course. The Surveyor next regrets that the Committee make so many statements which are mere matters of opinion, and respecting which nothing can be proved either way, and then proceeds to impale Mr. Murray upon the horns of a very practical dilemma in the following passage, which contains its own explanation. "The insinuation," he says, "that measurers have a feeling of sym-"pathy towards the men from among whom "they have been selected, could scarcely have "been expected from a Committee who, in "speaking of the necessary qualifications for a "measurer, make the following recommenda-"tion: 'In addition to the honesty and probity "'necessary in these officers, it is required, to "'prevent imposition upon them by the work-"'men, that they should be shrewd, active, "'practical men, of great experience, thoroughly "'acquainted with work in all its details, and "'also with its quality.' Where, it may be "asked," says the Surveyor caustically—"where "are such men to be found but in the ranks of "the workmen? And yet, when selections "are made from that class of men, their sup-"posed sympathies towards the class from "which they have been raised, are urged against "the arrangement."

Sir Baldwin next gives his victims a sarcastic thrust, by remarking that it cannot be unobserved how frequently the same subject is taken up by the Committee "in two different points "of view, to bear upon directly opposite pur-"poses," and proceeding to give instances of this very characteristic tendency. Again, we are reminded by the Surveyor that a certain proposal of the Committee's would not be likely to be made by any one who at all understood the working of the service. Further on we meet with the remark that the importance of obtaining workmanship of the highest quality in our ships of war cannot be fully appreciated except by those who have witnessed the evil effects caused by indifferent workmanship—a very pertinent and appropriate observation. So far does the Surveyor carry this sort of thing that he appears to grow quite playful—tormentingly playful—over it: witness the following sentence: "Many of the suggestions contained "in the Report are nothing more than a repeti-"tion of the every-day practices of the service, "*although perhaps the Committee may not be* "*aware that such is the case.*" And in the same vein—"when it is borne in mind that no mem-"ber who signed the Report is practically "acquainted with the subject, their opinion, "when unsupported by the evidence of compe-"tent persons or by unquestionable facts, must "be received with that limited confidence due "to opinions so formed:" and still in the same vein—"the Committee seem to imagine that "the practices of private trade ought to be fol-"lowed, right or wrong, suitable or unsuitable; "the mere fact of private builders having "adopted them seems, in the opinion of the "Committee, to be a sufficient reason for their "adoption in the Government yards; the only "additional reason assigned is curious, namely, "that Dockyards are of old standing, and there-"fore it is not to be expected that they will "bear a comparison with private establishments "of the day. This certainly is a new kind of "reasoning, as experience is generally consi-"dered calculated to lead to improvement."

Having thus shown how lightly Sir Baldwin Walker has treated Mr. Murray's effort, there is nothing more to be said at present on that head. Colonel Greene, on his part, answers it much the same way. The real point at issue, in so far as the New Works Department is concerned, is, he says, this: whether every practical officer at every establishment is to have his own way, or whether the service generally is to have the benefit of the experience derived from all the establishments as centred in his office; and he adds, "the Committee "being composed chiefly of local officers natu-"rally incline to the former conclusion; *but* "*common sense and reason would support the* "*latter.*" Softly, Colonel, say we. Are you

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quite sure you are right in thus setting all "local officers," as such, at war with common sense and reason? We think not. We think rather that you are visiting the sins of one or two only on the heads of all. Surely it is possible for a man to be a dockyard officer without naturally feeling averse either to common sense or to reason!

The general argument of the Colonel is, however, plausible enough; (how strange it seems, by the bye, that we should have a civilian at the head of our navy, and a *Colonel* at the head of an *Admiralty* Department: but let that pass). He argues that it seldom occurs to dockyard officers—("local *practical* officers" he calls them, without meaning any reproach, we hope)—to have to "project the particulars" of a foundry, a factory, or a workshop; seldom even of a dock, or other large work; whereas his "office" is constantly engaged in designing and constructing such works at one or other of the establishments, and consequently accumulates an amount of experience and knowledge of the details of all naval buildings such as no local officer of any length of service could possibly acquire. It is only through his office that improvements which have been adopted at any one yard can be introduced into another. Such improvements or innovations, he says, are very frequently opposed to local practices and prejudices, and it requires all, and more than all, the means at present enjoyed by his office to disseminate such improvements." The assistance of the Board of Admiralty has had to be invoked to support the views of the "office" in furtherance of "almost self-obvious improvements"—whatever they may happen to be. We have a glimpse here of the hostilities which have prevailed, as we stated some weeks since, between the Director of Works and the "practical" officers. And in the next sentence of the Colonel's the hostile spirit again reveals itself: "It would be curious and instructive "to compare the crude plans and suggestions "which have emanated from the local officers "with the well-considered structures which "have been actually built." And again: "Al- "most everything in the way of improvement "connected with this department has either "emanated from, been matured in, or dissemi- "nated by, this office; yet the Committee would "ignore all the experience of this office." In concluding Colonel Greene grows even yet more confident in "his office," and gives a hint to the Board of Admiralty itself on the subject. If, he says, the Board desire their work to be well and efficiently done, without any unnecessary delay—(which Colonel Greene does not intend to question, surely)—and if they have that confidence which they "ought to have" in his office, they should strengthen the hands of his department, "and not put it in the position of "having to fight its way for every great or "trifling matter with every local officer at every "establishment."

We have, then, the authority of Colonel Greene himself for saying that his department is continually at war on every question that arises, whether great or trifling, with the officers of all Her Majesty's naval establishments. Surely we have here, if not a confirmation of the Committee's views, at least an evidence that changes of some kind are pressingly necessary. There is, we readily admit, much truth in the theory he propounds—that a central office for the control of Admiralty New Works ought to produce better results than could be reasonably expected from the isolated action of the officers of the separate establishments. And we further admit that Colonel Greene and Mr. Scamp have done much, very much, to promote the efficiency of our Admiralty Works. Still it cannot be denied that an immense amount of dissatisfaction exists in the Dockyards in respect to some of the newly-constructed buildings. We ourselves receive so many complaints that we know not how to hope for any peace until something has been done to restore confidence in the "Office." Of the letters of our correspondents we have given place to only two, which appeared in our last month's numbers. But what do the writers say? "A Mechanic," of Pembroke Dockyard, states that above the new steam saw mill recently completed in that establishment a joiner's shop with a glass roof has been fitted up in which no means of ventilation were provided, and that "the place became so unbearably hot during the "summer that large holes were obliged to be torn "in the new end walls to admit a current of air." "A Sidelight," writing subsequently from Deptford, tells us that we "need not travel so far as Pembroke Dockyard to witness "Colonel "Greene's mania for glass roofs," for in Deptford yard they have a similar building with a glass roof to give light and a canvas awning to keep it dark, "the workmen preferring darkness "to being baked alive." Near it, he says, is a store for "dry goods" with a glass roof so contrived that the upper floor is "like an oven "when the sun shines, and like a shower-bath "when it rains." He further tells us that in the victualling yard is another like structure, the oppressive heat of which in summer time caused the people to strike work and protest against it, while in the winter, snow six inches deep is often found on the floor of it. There may be, and probably is, a certain amount of exaggeration in these statements, but they could hardly have been made, much less could similar statements have been made in several quarters simultaneously, if no considerable grounds for them existed. We are quite aware that the buildings in question have been constructed with a single eye to the interests of the service, and we know further that the new joiners' shops which are so much spoken against are infinitely superior in several instances to those which they have replaced, affording facilities, as they do, for economising labour by providing for the introduction of machinery—a thing which was never in the least considered, or even thought of, in our Dockyards, to any proper extent, until Mr. Scamp exerted himself to secure its introduction. Still further, we know how easy it is to invest little oversights and errors with an imposing amount of importance when the object is to enlist the services of the Press in a war against a Government Department. But making allowances for all these things enough still remains, we think, to warrant us in asking for some species of change which shall tend to a better understanding between the New Works Office and the Dockyards, especially as Colonel Greene himself asks for the same thing—prescribing *his* method of accomplishing it. We must say, also, we should have been glad to see a little less of Ishmael's spirit in Colonel Greene's rejoinder. When we find a man fighting on "every matter" with "every local officer at every establishment," we cannot help suspecting there is a slight chance of his being sometimes in the wrong!

But the skirmishes of the Surveyor of the Navy and the Director of Works with the Committee have withdrawn our attention from the conflict itself. It was round the shield of Mr. Chatfield that the true battle raged, and most ably and worthily did the single-handed champion meet his adversaries. There is a great risk of our doing too little justice to Mr. Chatfield in this matter. With the Tory Government—whose purposes this Committee were to serve—gone, and with it all chance of the Report exerting any direct influence, it seems of little consequence that one of the members of the Committee protested against it, and drew up an able statement by way of reply to it. But had a change of Government not occurred, an attempt would have been made to carry out Mr. Murray's recommendations, and to entail upon the country all the mischief which would inevitably have flowed from them. In that case, we should have seen the value of Mr. Chatfield's masterly rejoinder. For it is a masterly document; we have looked through it several times, and have examined much of it carefully; and, although we shall have occasion to differ from him when we come to discuss some questions which he has considered, we cannot refrain from expressing the high sense we entertain of both the professional skill and the industry which are manifested in it.

We have now, however, occupied so much space with this article, that we must defer further observations on the Report for the present. Only a close investigation of such topics as are there discussed can be of service to the country; and such an investigation must of necessity be proceeded with deliberately.

THE VENTILATION OF DWELLINGS.

IT was with weighty reason and sound judgment that the Sanitary Commission lately recommended that the elements of physiology should be made, as far as possible, a part of popular education; and the wisdom shown by the Government in adopting the suggestion cannot be too highly praised. We are happy to be able to state that steps have already been taken to obtain a useful work on the above subject, free from all technicality, for the instruction of those who most need its teaching. When in conjunction with this token of progress we consider the important labours of the Association for the Promotion of Social Science, we may reasonably expect ere long to find proofs of the beneficial effects of the application of knowledge to the general well-being of the people. Science, which is now seeking its broadest field of utility, has quitted the guidance of mere intellectual ambition, to become, in the hands of the philanthropist, a mighty agency of good. It is no longer in our time to be barren, but fruitful in those results which may be seen in every home, and evidenced in the physical improvement and increased comfort of the labourer and artizan throughout the land.

The ignorance of the first conditions of animal health, as manifested in the total disregard of the necessity for the adequate ventilation of dwellings, may safely be asserted to have been productive of a greater amount of physical evil than that resulting from any similar cause. Although of more importance than the very food we eat, the supply of fresh air has been systematically excluded whenever the necessity has been felt of procuring the aid of artificial warmth. The cause of this fatal mistake is simply that the latter necessity is felt; that of fresh air, through which alone the vital heat can be sustained, is not understood. The blood becomes heavy and carbonised, the system weakened, the liver diseased, before the effect can be traced to its cause. Our winter climate is by no means of necessity less healthy than the summer. But, by the exclusion of all external air in guarding against cold, the frame becomes liable to its most dangerous effects. Whenever the imperfect construction of doors and of windows renders this exclusion impossible, a comparative degree of health prevails. Among the Irish peasantry, where this accidental cause is most active in producing ventilation,

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the absence of an asphyxiating atmosphere throughout the year more than counterbalances any insufficiency of food or want of attention to cleanliness. On the other hand, where the contrivance of double windows is in use, as in Canada; or where the window is not even made to open, as in some of the mining districts of Wales, the result is found in the excessive infant mortality, the dwindled frames of the surviving children, the fading of the bloom of young women, and the pallor and failing energies even of strong men. The same result again is seen in the effects upon the appearance and strength of whole regiments of soldiers, occasioned by their close winter quarters. In Canada, men, women, and children do not look like the same persons a month after they have relinquished their winter contrivances for guarding against cold. But, to the few who attach sufficient importance to adequate ventilation, the winter of Canada is fully as healthy as the summer.

In a sanitary point of view the English open grate is a far superior contrivance to the Canadian stove—the proper disposition and management of which is a subject of such great anxiety at the commencement of the cold season in our North American colony. These stoves certainly realize a much greater amount of heat in proportion to the fuel consumed; but the advantage is lost of the imperfect ventilation afforded by the open chimney; and they are consequently more destructive of health and life. But neither in England nor America does there appear to exist the slightest inkling of the fact that the supply of air for respiration and for securing the smoke-draught may by very simple means be warmed by the fire itself. The main supply of air for the combustion of the fuel, however it may be reduced, *must*, under ordinary circumstances, be drawn from the exterior atmosphere through every chink and cranny; or, descending by the chimney, it fills the apartment with smoke and the gaseous products of combustion. Thus it is that the small currents of cold air, intersecting each other in every point of the confined space, are felt even in the closest atmosphere of rooms heated either by stove or by open grate. No application has ever been generally made of the obvious fact that the necessary air-supply may be drawn through pipes communicating with the external atmosphere, and heated by means of the burning fuel. The fresh air thus obtained would be both pure and warm, and would moreover replace that drawn by powerful suction through the above-mentioned chinks and crannies.

We remember assisting at an experiment the object of which was to obtain a supply of cold air during the heat of summer. For this purpose ventilating apertures were opened near the ceiling, and a metallic pipe of considerable diameter was made to communicate with the heated external air of the slated roof and to descend into the apartment. The lower portion of this pipe was then surrounded by a casing, and exposed to the effect of a freezing mixture. The result of this contrivance was a continued descent of the column of refrigerated air within the tube; forming a current which was made to impinge upon and pass through a surface kept moist by capillary attraction. By this means the temperature of the apartment was considerably reduced; but the practical advantage of the process was, for several reasons, very questionable. It is to the converse of this operation that we would specially direct the attention of our readers. The air which has become vitiated by the combustion of fuel escapes up the chimney or flue in virtue of the heat, through which its specific gravity is rendered less than that of the surrounding atmosphere. To replace this stream of air which is continually abstracted by the draught of the fire is a matter which never enters into our thoughts; we leave it to replace itself without troubling ourselves as to the means whereby this is effected. A very small proportion of the total heat of the fuel is radiated into the apartment: and the remainder is expended in heating the current which escapes into the outer atmosphere. It would be easy to replace this air by the same means which occasions its discharge; and it would seem to be a very natural expedient to obtain a supply to the interior through the same agency which causes the outward draught. The discharge which takes place from the apartment through the heat of the fuel should be counterbalanced by an inward supply from the same cause. An iron pipe leading upwards from the exterior through the fuel and into the room would occasion a current to be established in either direction, and place the air which is lost and that which is admitted under similar conditions. Strange it is that hitherto our care has been to heat the former alone. The simple expedient we have pointed out suffices to fulfil the conditions of a perfect source of heat. The means for the hot-air supply need not even be visible; and this can be regulated without trouble by the ordinary ventilating contrivance.

It is more especially in the night time, when, during sleep, the animal heat requires to be sustained by wholesome respiration, and preserved by a warm atmosphere, that the evil effects resulting on the one hand from a close bedroom, and on the other by cold draughts of air into the apartment are most active. With the present means for obtaining artificial heat it is impossible wholly to escape them. Whatever course we may adopt in our endeavour to do so, is found, during the prevalence of the sudden changes of temperature to which our climate is liable, to lead to the same result. We may keep out the cold, but in so doing we inevitably weaken our powers of resisting its effects by diminishing the heat-producing function of respiration. What is peculiarly required, therefore, in our artificial sources of heat, is a self-acting contrivance by which the amount of respirable air in the apartment should be increased in proportion to the necessity for sustaining the warmth of the body. That such a contrivance is practicable and easy of attainment is sufficiently obvious; that it has hitherto been neglected, to the detriment of our health and well-being, must equally excite our surprise and our regret in realising the fact that mankind should suffer so much from causes which are within our own control, and which admit of so easy a remedy.

ON SURFACE CONDENSATION.

By J. P. Joule, LL.D., F.R.S.*

The author described the experiments he had made on this important subject. A peculiar arrangement he had introduced gave a very increased effect to a given surface. In this arrangement a copper spiral was placed in the water spaces. The spiral had the effect of giving the water a rotatory motion, and the water was thus compelled to travel over a larger surface than it otherwise would do. He also pointed out that he had succeeded in producing a better vacuum than the temperature of the condensing and condensed water appeared to warrant, and that thus a fresh and unexpected advantage was proved to belong to the system of surface condensation.

* British Association, 1859.

ON THE PERFORMANCE OF STEAM VESSELS.

By Vice-Admiral Moorsom, R.N.*

At the last Meeting of the Association at Leeds, a paper "On the Performance of Steam Vessels" was read, in which some account was given of the Erminia, a yacht belonging to Lord Dufferin, and I have now to present some particulars of her performance.

A return has been handed by Mr. M'Connell to the "Steam Ship Performance Committee," of certain trials of the Erminia in Stokes Bay, on the 12th October last; and the following further particulars of that vessel and her engines will enable the members of the Association to follow me in the description I am now about to give, and to check any errors into which I may have fallen:—

Length of water-line		92·20 feet.
Breadth, extreme		22·66 „
Draught of water	F.	9·50 „
	A.	12·00 „
Displacement, about		244 tons.
Area of greatest transverse section		149·18 sq. feet.
Diameter of screw		8 feet.
Pitch of do.		13 „
Length		1·34 „
Extreme breadth of each blade		3·00 „
Area of blade, about		15·5 sq. feet.
Immersion of periphery		2·5 feet.
Diameter of cylinder		15 inches.
Length of stroke		18 „
Area of fire-grate		14·124 sq. feet.
„ fire-box		92·96 „
„ tubes		449·33 „
„ steam ports		12 × 1¼ inches.
Diameter of blast pipes		4 „

The performance at the measured mile, being the mean of four trips, was as follows:—

Speed of vessel—knots	6
„ screw „	6·72
Slip per cent.	10·66
Revolutions per minute	52·37
Indicator horse-power by 8 diagrams	54·59
Mean pressure in boiler	51·80 lbs.
„ in cylinder	32·07 „

I had written to Lord Dufferin in August, that I anticipated a speed of 6 knots from 90 horse-power, and that I had selected a *coarser* pitch than I should otherwise have preferred, in consequence of some difficulty in estimating the thrust, and that the slip might be about 21 per cent. The results show a much better performance, and I must now explain the data on which my calculations were based. The resistance of the vessel at 6 knots in smooth water was first estimated by resolving the resisting surfaces into equivalent plane surface, and deducing the specific resistance of form by an empirical application of the method of Don Gorges Juan. This gave 2763·5 lbs. It was, secondly, estimated by another empirical process, which I had found to answer within given limits of form, and was founded on Beaufoy's experiments. This gave a specific resistance of 1,896 lbs. In the absence of experiments that can be depended on for determining the thrust of the screw, I considered it safest to adopt the larger resistance, and to take as large a diameter for the screw as would admit of its being effectually immersed, so that the thrust should not be broken, and 8 feet was selected. Now, the pitch of a screw of 8 feet diameter, to produce a *resultant* thrust of 2763·5 lbs. at 6 knots, is 13·37 feet. The pitch selected being 13 feet, the slip to balance should be 21·11 per cent. Then, how comes the actual slip to be only 10·66 per cent.?

The answer to this is the key to the whole operation, and it is this:—The *direct* thrust of the screw under the actual circumstances of the trial was 2122·7 lbs., and the *resultant* was 1896·4 lbs., and the difference of the ratios of their square roots is 10·66. But 1896 lbs. is also the specific resistance as estimated by the second method, and as the thrust calculated by an independent process comes out the same, within half a pound, the concurrence of the two seems to establish *that* as the actual resistance at the time

* British Association, 1859.

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of the trial. Such concurrence may not, however, be held to be conclusive.

Figures are said to have sometimes a singular facility in producing pleasant results. There are two modes by which these results may be tested, the one analytical, the other synthetical. I will begin with the first, and employ the other in elucidation. The effective power, or total resistance, from the actual power of 54·59 horse-power, or 1,801,470 lbs. at 6 knots, is 2961·67 lbs., which is thus distributed :—

Specific resistance	1896	lbs.
Equivalent of slip	315·67	„
Resultant of absorbed power	750	„
Total	2961·67	„

I have in this analysis, as in my former paper, classed under the general term "equivalent of slip" two distinct elements, which I must now separate. The first is, that portion of the effective power which overcomes the resistance of the water to the rotation of the blades of the screw, and which is sometimes called "lateral slip." The second is, that portion of the effective power which is employed in pushing back the water to obtain a fulcrum.

The first is	204	lbs.
The second is	111·67	„
Making together the ...	315·67	„

The absorbed power is composed of—1st, the friction of moving the machinery; 2nd, the additional friction of the load; 3rd, the back-pressure (as we are dealing with a non-condensing engine) from the blast-pipes.

For the first we have	136·92	lbs.
„ second	189·60	„
„ third	423·48	„
Making the total of	750	„

In order to give a clearer view of these elements I will reverse them and show the corresponding pressure upon the piston.

	lbs.	Pressure on Piston lbs. per square inch.
Back-pressure	423·48	4·64
Additional friction of load	189·60	2·07
Moving friction	136·92	1·50
Resistance of water to rotation of blades	204·00	2·23
Slip in terms of effective power	111·67	1·22
Specific resistance of vessel	1896·00	20·78
Making the totals of	2961·67	and 32·44

The pressure on the piston by the diagrams is 32·07 lbs., showing a difference of 0·37, which may be considered near enough. Now, if it be said that this is an arbitrary classification not resting upon known data, I reply not altogether so. I have lying before me diagrams of back-pressure from 3·45 lbs. per square inch on the piston, moving at 236 feet per minute, with a mean pressure of 67·56 lbs. to 12·3 lbs. per square inch on the piston, moving at 569 feet per minute, with a mean pressure of 65 lbs., the diameters of blast-pipes varying from 4¼ to 4½ inches, and the relations of steam ports from 14 × 1⅝ inches to 12¼ × 1¼ inches of area The Erminia's blast-pipes were 4 inches in diameter, the steam ports 12 × 1¼, and the speed of piston 157 feet per minute, with a pressure of 32·07 lbs. per square inch in the cylinder. The back-pressure of 4·64 lbs. which results from the analysis is, therefore, probable, and consistent with experience. The next element of additional friction arising from the load, viz., 2·07 lbs. per square inch, is calculated upon the specific resistance of 1896 lbs., and may be disputed, because there are no satisfactory experiments on the subject. It is an estimate, and may be in excess. The next element of the pressure to move the machinery, viz., 1·5 lb. per square inch, is a little over the mean of certain trials made by my direction, of which the diagrams are before me, the maximum being 1·14 lbs. To this no reasonable exception can be taken. The resistance to the rotation of the blades, 2·23 lbs., is calculated upon the basis of such experiments as I have access to on the friction of water on iron, and on the effective periphery of the screw. For this element, also, more precise experiments are needed, and it must be considered an estimate only. The slip, 1·22 lbs., requires no elucidation, except that it is what remains after deducting the effect of the resistance equal to the rotation of the blades. The specific resistance equal to 20·78 lbs. per square inch on the piston, or in the convertible terms of 1896 lbs. of effective power, may therefore be dealt with as a probable result, and if so, the power of the screw is needlessly in excess of any resistance the Erminia is likely to offer, and I have explained why it is so, viz., because it was designed to produce a thrust at about 21 per cent. of slip, about 50 per cent. greater than the resistance of the vessel *in smooth water*, which resistance, viz., 2763·5 lbs., turns out to be 45 per cent. greater than the actual resistance. Hence the screw is *capable* of a thrust nearly double of what the Erminia requires in smooth water. What, then, is the most suitable size and proportion of screw for this yacht? I believe it will be found that the diameter should be as large as is consistent with its being *sufficiently* immersed, but no larger, and that the pitch should be then such as to produce a thrust to balance the resistance under ordinary considerations at sea with a moderate slip. If the screw be 8 feet diameter, then, to produce a thrust of 1896 lbs. at 6 knots, the pitch must be 9·18 feet, and the slip about 13½ per cent. But, under ordinary conditions at sea, the resistance will be increased, and it is expedient to have a coarser pitch, in order that the thrust may balance the resistance without excessive slip. If we assume the specific resistance at a mean between the two calculated results before described, or 2329·75 lbs., the pitch must be 11·27 feet; and when the thrust works up to this resistance, the slip will be about 20 per cent.

I must now draw attention to other trials of the Erminia, viz. :—

First, on the 27th September:

Speed of vessel	6·83	knots.
„ screw	7·76	„
Slip per cent.	10·75	
No. of revolutions	60·05	
Mean pressure in cylinder	45	lbs.
Indicator horse-power	87·40	
Diameter of screw	8	feet.
Pitch „	13	„

The results alone of this trial were sent to me, and not the particulars; and I have no means of checking them. On comparing the speed with that obtained on the 12th October—viz., 6 knots, with 54·59 horse-power—it will be found to be less than it should be—viz., 6·83 knots, instead of 7.

Second, on the 28th September :—

Speed of vessel	7·98	knots.
„ screw	10·39	„
„ slip per cent.	23	
No. of revolutions	81	
Mean pressure in cylinder	46	lbs. per sq. in.
Indicator horse-power	121·9	
Diameter of Screw	7	feet.
Pitch „	13	„

In this case, also, I was only furnished with results. The speed comes out a little beyond what it should be compared with the conditions of 12th October, viz., 7·98, instead of 7·84 knots. It will be seen that the slip is more than double of that which took place on the two trials with the 8-foot screw, on the 27th September and 12th October, and more than two per cent. greater than that which I had estimated as due to the thrust to balance the resistance of 2763·5 lbs.

In a report to the Admiralty, by Admiral Ramsay, Mr. Nasmyth, and Mr. Ward, occurs the following passage:—"All the evidence received shows that, where a ship has very fine lines, a coarse-pitched screw, with comparatively small diameter, gives the greatest speed." The language in which this proposition is couched and the condition by which it is guarded prevent me, in the absence of the evidence on which it is founded, from saying more than that I must doubt the conclusion till I see facts in its support. It seems to be quite at variance with the principle on which the action of the screw rests; but here is an example to bear out the proposition.

Having received some particulars of the Erminia's passage under steam from Malta to Alexandria, from the 7th to 9th of December, I may suitably introduce them here :—

Speed of vessel (mean average)	6·50	knots.
„ Screw	9·87	„
Slip per cent.	34·20	
No. of revolutions	77	
Pressure in boiler	60	lbs.
Coal used in 45·5 hours	8	tons.

These particulars are not sufficient to justify any deductions, and mere inferences might only mislead. There is no risk of being far wrong, however, in saying that the resistance in this passage must have increased in a greater ratio than the increase of speed would account for. The diameter of the screw, 7 feet, with the original pitch of 13 feet, accounts for the slip of 34·2 per cent.—on the supposition only of an increased ratio of resistance. The next vessel to which I must invite attention is the yacht of the Duke of Sutherland, mentioned in my former paper. Full particulars of the performance of the Undine at the measured mile in the Thames, on the 6th July, 1858, in Loch-Lochy on the 27th October, and in Loch-Ness on the preceding day, have been laid before the "Steam Ship Performance Committee" by Mr. M'Connell.

The particulars of this vessel are :—

Length of water-line	125	feet.
Breadth, extreme	25	„
Draught of water { F.	8·6	inch.
{ A.	11·10	„
Displacement about	294	tons.
Area of greatest transverse section	154·33	sq. feet.
Diameter of screw	7·10	inch.
Pitch, &c.	11·4	„
Length	1·4	„
Extreme breadth of blade	2·8	„
Area of blade about	13	square feet.
Immersion of periphery	1·8	inch.
Diameter of cylinder	0·24	„
Stroke	0·15	„
Area of fire-grate	45	sq. feet.
Plate surface	206	„
Tubes	820	„

The performance on the 6th July was :—

Speed of vessel	9·26	knots.
Screw	11·29	„
Slip per cent.	17·91	
Revolutions per minute	101·74	
Indicator horse-power by diagrams	157·09	
	lbs.	per sq. in.
Mean pressure in cylinder	12·28	„
„ from vacuum	10·70	„
Total pressure	22·98	„
Mean pressure in boiler	15·80	„

Now, the specific resistance of the Undine at 9·26 knots estimated as the Erminia's, by the empirical rule founded on Beaufoy's experiments, is 3809·4 lbs.

By the synthetical method it is as under, viz. :—

Moving friction	1·40	...	343·89
Additional friction for load	1·55	...	380·94
Resistance to rotation of blades	2·37	...	582·50
Slip in terms of effective power	1 65	...	406·10
Total less specific resistance	6·97	...	1711 43
Total pressure and effective power	22·51	...	5517
Specific resistance	15·54	...	3805·57

The difference between 3805·57 and 3809·4 is not material in estimates such as this. It will be seen, also, that there is a difference of 0·47 lbs. per square inch in the aggregate pressure as compared with that given by the diagrams. So far the two methods are in harmony; but now I have to show a screw that is not so tractable. The *direct* thrust at 11·29 knots, is 7469·3 lbs., and the slip being 17·91 per cent., the *resultant* is 5022·3 lbs., or more than 31 per cent. greater than the resistance of the vessel. This, however, cannot be so, and the apparent excess must be accounted for.

I have already said that the screw must be *sufficiently* immersed, in order that its thrust may be that which is due to its diameter and pitch. What is *sufficient* is yet an open question. The

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Erminia's was 2 feet 6 inches, the Undine's only 1 foot 8 inches. I believe this to be the explanation of the anomaly. The apparent thrust of 5022·3 lbs. was really an effective thrust of only 3805·57 lbs., in consequence of the rotation of the blade breaking up the surface of the water. This screw would produce, if sufficiently immersed, a resultant thrust of 3805·57 lbs. at 9·26 knots, with a slip of 10·32, say 10¼ per cent. The actual slip was 17·91 per cent. I have found the same results in several ships of war. In all whose screws are near the surface. In none whose screws are buried.

We have now reached one of the most interesting of the investigations, which, in my former memoranda, I pointed out as worthy of the attention of the British Association. This is an investigation by experiment not difficult to accomplish, and yet I conclude it has not had the consideration of the naval authorities, as they continue to give screws to their ships, which are only immersed about one-fourth to one-eighth of their diameter, whereas the Erminia's was immersed about one-third, while the Undine's was about one-fifth. The due proportion of immerson will, I believe, be found to depend somewhat on the speed of rotation. I wish to guard myself against being misunderstood as to these estimates. They are rough approximations thrown out for the purpose of bringing to a practical issue the application of certain known laws of fluids. The application here is, as I have repeatedly declared, *purely empirical*.

It is the result of the observation and experience of one who has no theory to advance or to support, but who, as a sea officer, and as having also been actively engaged in the construction of some of the greatest public works of this country, and as being now occupied in the management of one of its largest commercial undertakings—has been in the habit of recording and classifying facts with a view to the induction of laws, and to bring within the sphere of scientific calculation what is generally determined by the sort of experience popularly called the "rule of thumb." He knows by experience that accuracy may be ensured, and time and money saved by estimates, however rough, if based on ascertained facts, as against opinions the most experienced; and he believes that the laws which govern the resistances of ships under various conditions, may be ascertained sufficiently to guard against the mistakes of which every one concerned in shipping is aware.

There are two packets plying between Holyhead and Kingston which have made that passage at the rate of nearly nineteen statute miles an hour, and their displacement is only about 600 tons. When, in 1846, those vessels were designed, though I had no responsibility in designing them, I told my colleagues that their speed might reach twenty statute miles an hour. That was not a *guess*, it was an *estimate*. It turned out, however, that the requisite length could not be given to them. One of these vessels is capable of making way against any head sea and wind short of a hurricane. In running before the wind she is uneasy, and requires nice management. The other cannot encounter a heavy head-sea like the first, but she "scuds" with ease and comfort. A seaman will give a reason for this difference, and probably he might be right; but I doubt if he could show how a vessel is to be designed so as to unite the two best qualities of each. Yet their union is practicable; and in the records from which are compiled the returns presented to the "Steam Ship Performance Committee" are the facts which would enable a scientific naval architect to effect that union.

A question may here be asked which I am not in a condition to answer. Has the speed of ships increased in the ratio due to their increase of size? Does the speed of the Mersey, of 5462 tons, being about 13½ knots, with 4014 horse-power, answer to the deductions of science when compared with the Rattler of 1078 tons, with a speed of about 9½ knots, with 436·7 horse-power? If not, there may be reasons why not; but I have failed to discover them. I think information on this point would be valuable to science. I had intended to make some observations on the high-pressure engines in the gun-boats, but I must postpone them for a future occasion, with this remark: That the high-pressure engines whose performance I have investigated are not fair specimens of their class; and any conclusions drawn from them, as to their suitableness for ships of war, must be inconclusive.

I have felt it to be due on my part to the British Association, to bestow some pains on the matters submitted in this paper, not only as an acknowledgement of the ready attention paid to my suggestion in my absence, both last year and in Dublin, for the appointment of a committee, but also to show what may be done, and what there is to do. I trust I have shown that there is a practical issue before us worthy of the labour; that these are not the speculations of a theorist unversed in practical life, which, however amusing in the closet, can determine no actual issues, but that they have a vital bearing on questions which now exercise some of the keenest intellects of our day. The science of war has, as we all know, called forth the most practical development of the human mind. At this moment all the resources of mechanical art are stimulated to the utmost to produce, or to perfect, instruments of war. Ships are in this category. Where are the admitted laws which are to guide us? Who can point them out? I, therefore, again suggest the renewal of the powers of the committee appointed at Leeds, with some extension of their objects.

I cannot close this paper without making some attempt to discharge the debt of acknowledgement on the part of science, which I feel to be due to the two noblemen whose experiments with their yachts have enabled me to make this exposition of what I conceive to be the principle of the screw in its relation to ships. Experiment can alone prove or disprove my positions. But in either event, the Marquis of Stafford and Lord Dufferin are thankworthy, who at some cost have taken a course which *seemed to have* the sanction of science.

Experiments of this nature ought to be undertaken by Government — they, representing the nation, have the largest interest at stake, and the amplest means at command. If it should turn out that the investigation here unfolded leads to determine the relations between the *direct* thrust of the screw and its *resultant*, and between that and the form of the vessel, one more instance will be added to the many our country offers of the value of voluntary associations in stimulating individuals in the pursuit of a common object; and I shall have some satisfaction in thus vindicating the claim to be considered a scientific sea-officer, to which I once fancied I had some pretensions and to which I still attach some value. Nevertheless, I should not have gone out of my way to make public such investigations as these which have amused my leisure hours, if it had not been for the British Association for the Advancement of Science.

C. R. Moorsom.

Highfield, August, 1859.

THE WESTMINSTER CLOCK.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—So soon as the quarter-chimes had been set going and the hands had been placed on all the dials, I thought it desirable that some efficient steps should be taken to obtain a correct rate of the clock's performance, and therefore proposed to Mr. Quarm to fix up an astronomical clock in his office, at the Houses of Parliament. To this proposal Mr. Quarm at once acceded, and cheerfully undertook the task of observing the rates.

One of the finest astronomical clocks that I have produced was consequently selected, and placed in Mr. Quarm's office on 28th September; and in order to afford additional confidence in the results, I attended personally to the fixing and adjusting of the pendulum and arc spring, &c. The whole of the adjusting did not occupy two hours, and it may be remarked that the clock at once went to actual mean time within eight-tenths of a second a day without subsequent regulation. The next step was to ascertain by trial the degree of accuracy which Mr. Quarm was likely to attain in taking the rates; several comparisons of the first blow of the quarter chimes with the astronomical clock were consequently made by him, simultaneously with those made by myself, and the results each time were within two-tenths of a second.

These arrangements having been completed, the following rates of the Westminster clock were taken by Mr. Quarm, from the first blow of the quarters and the first blow of the hour:—

1859.	Time of Observation.	Westminster Clock Fast or Slow of Astronomical Clock.	Difference in Gain or Loss of the Westminster Clock from one observation to the next.
	H. M.	S.	S.
Sept. 29	10 30	S. ... 9·8	
,,	10 45	S. ... 10·2	L. ... 0·4
,,	11 0	S. ... 4·0	G. ... 6·2
,,	12 0	S. ... 4·0	0·0
,,	12 15	S. ... 2·6	G. ... 1·4
,,	12 30	S. ... 10·2	L. ... 7·6
,,	1 0	S. ... 1·4	G. ... 5·8
,,	1 30	S. ... 12·8	L. ... 8·4
,,	1 45	S. ... 12·8	0 0
,,	2 0	S. ... 4·2	G. ... 8·6
,,	2 15	S. ... 2·4	G. ... 1·8
,,	2 30	S. ... 10·2	L. ... 7·8
Sept. 30	10 45	S. ... 9·0	
,,	12 0	S. ... 4·0	G. ... 5·0
,,	12 15	S. ... 6·2	L. ... 2·2
,,	12 30	S. ... 12·2	L. ... 6·0
,,	12 45	S. ... 8·4	G. ... 3·8
,,	1 45	S. ... 9·0	L. ... 0·6
,,	3 0	S. ... 6·2	G. ... 2·8
,,	3 30	S. ... 11·6	L. ... 4·4
,,	4 30	S. ... 8·0	G. ... 3·6
Oct. 1	10 30	S. ... 11·6	
,,	11 0	S. ... 3·6	G. ... 8·0
,,	12 30	S. ... 7·6	L. ... 4·0
,,	1 0	S. ... 5·0	G. ... 2·6

No rates were taken after this time, in consequence of the hour and quarter parts being stopped, on account of the fracture of the great bell.

It will be observed, in the foregoing table, that instead of the clock proclaiming Greenwich time within one second in 24 hours, according to the stipulated conditions, it occasionally varies more than eight seconds in a quarter of an hour.

In order to eliminate the error of the astronomical clock I have looked over several years' rates of it, taken by the late Mr. Belville, of the Greenwich Observatory, to ascertain the probable quantity, and found it to amount to rather less than two hundreths of a second for the longest interval between the observations recorded in the Westminster rates.

Besides the above, I have other rates which were previously taken by myself, with a chronometer, on Sept. 12, 13, and 28, and they show that the Westminster clock did not indicate time more accurately on those days.

In my letter, dated July 30, published in the Mechanics' Magazine and *Journal of the Society of Arts*, it is stated, as my settled conviction, founded on a patient and elaborate investigation of the going part, that the clock could not possibly keep time within the promised limit unless the construction were radically altered and the principle introduced which I then described. It will now be seen that the amount of error shown in the present rates more than fulfils the quantity I then prophesied.

E. T. Loseby.

11th October, 1859.

P.S.—To those not intimately acquainted with horology it may be explained that the arc-spring is an improvement for causing the long and short arcs of vibration of the pendulum to be performed in equal times. It was invented by me, and submitted to trials under the superintendence of the Astronomer Royal at the Greenwich Observatory, during the years 1851 and 1852, and Mr. Airy's reports thereon to the Government may be found in a Parliamentary Return to the House of Commons, No. 1006, Session, 1853.

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HOW BIG BEN SHOULD BE SUSPENDED.

MR. CHARLES W. LANCASTER, of ordnance and rifle celebrity, suggests that Big Ben might with great advantage be suspended in the following manner:—The bell should be provided with a strong sphere or spherical projection at the top, and this sphere or projection should be clasped by two hollow half-spherical sockets, brought together and bolted firmly up to the supporting beams. This would provide for the bell moving and vibrating with perfect freedom, there being nothing but the friction to interfere with its motion. When thus supported the bell should be struck, not "squarely," but tangentially, or nearly so, in order that the blows of the hammer may give a very slight motion to the bell round its axis, and thus continually bring a fresh surface beneath the hammer, instead of hammering continually on the same, or nearly same, point. The annexed engraving shows one method by which the improved plan of suspension may be carried out. Mr. Lancaster considers, however, that a simple spherical recess in the upper surface of two strong and well-supported plates, at the junction thereof, would be preferable to any other arrangement.

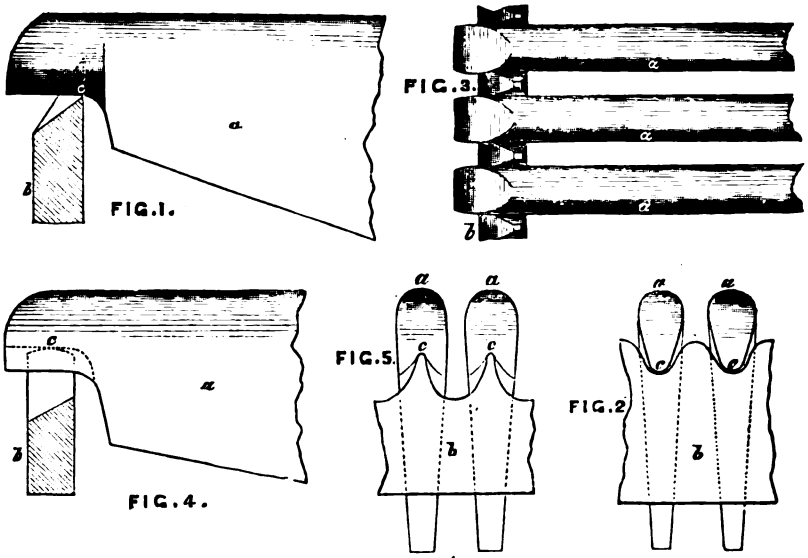
LEE STEVENS'S PENDULOUS FIRE-BARS.

THIS invention has for its object improvements in the fire-grates of locomotive, marine, and stationary furnaces; and consists in so arranging the fire-bars that they may be free to vibrate or swing, with a pendulous motion, on their points of support, where motion is given to them by the oscillation of locomotives or the rolling of steam vessels, and to facilitate the clearing away of clinkers, casually formed in stationary furnaces, with an ordinary pricker.

Figure 1 is a side view of part of a pendulous fire-bar, and also shows a transverse section of the cross-bearer; Fig. 2 is an end view of two similar bars and a side view of a portion of the cross bearer; and Fig. 3 is a plan of such bars and cross-bearers. Figs. 4 and 5 give side views and sections of another modification. *a a a* fire-bars; *b b b* crop-bearing bars; *c c c* points of vibrating suspension. Besides the above, there are hollow fire-bars described in the specification, which can be cheaply made of ordinary plate iron, or still thinner steel plates, of probably not more than one-third the weight of solid wrought or cast iron.

The pendulous action inherent to these arrangements of fire bars is too obvious to require any explanation; the leading feature being the avoidance of all reciprocating, rotary, or other complex machinery, to produce the desired effect, and consequent upon the trials to which the invention has been already subjected, the following are said by the inventor to be its ascertained advantages:—

LEE STEVENS'S PENDULOUS FIRE-BARS.



"1st. Greater durability for every purpose, in the ratio of at least 3 to 1. 2nd. Increased steam and economy of fuel; better combustion being caused by the uniform distribution of draught throughout the fire. 3rd. Ease of removal and replacement, each bar being independently separate from its fellows; instead of their being bound together, as the common bars are, by rectangular shoulders which virtually form dead plates from side to side of the furnace, immoveable in themselves and obstructive to the passage of air. 4th. Entire avoidance of clinkering in the fire-boxes of locomotives, and for marine purposes, consequent upon the vibratory action given to the bars by the oscillation of the first and the rolling motion of the second; with the least possible adhesion of clinkers to them even in the stationary furnaces. In the latter, as the pendulous fire-bars yield readily to the pricker, either above or below their points of suspension, they facilitate its use, and enable the stoker to clean his fires in one-fourth the usual time."

An express coal-burning locomotive has been running daily with a set of the pendulous fire-bars fitted nearly four months since, without any deterioration to them, although we understand within a similar period three sets of wrought iron bars would have been expended. During the journey of this locomotive of upwards of 250 miles, out and home, the bars by their pendulous motion keep quite clear of clinkers; whilst the more perfect combustion of the fuel, from the better and more uniform draught caused by their peculiarity of form and action, gets up and maintains steam more freely, and reduces the consumption of coal. In the other instance, at works belonging to Government, four stationary furnaces in which the pendulous bars have been severely tested for several months, are occasionally cleared with a common pricker in the time usually occupied in clearing one; and in which the advantages of uniformity of draught are equally perceptible.

SIR W. ARMSTRONG'S RIFLED 32-POUNDER.

WE regret to learn that the 32-pounder gun, of the ordinary muzzle-loading service type, which was given to Sir William Armstrong to be rifled according to a new method of rifling common ordnance lately devised by him (called the "shunting groove" method), has burst in the proofs to which it has been subjected. The principle upon which it was rifled was the very ingenious one of allowing the projectile to enter and pass into the gun by grooves in which it moved freely, and causing it to pass out again on the explosion of the charge through other grooves which it fitted tightly, and which imparted rotary motion to it. We also find that in the large "Armstrong gun" lately produced by him, Sir William has considerably modified his original method of construction.

LAYING-OFF; OR, THE GEOMETRY OF SHIPBUILDING.

No. VIII.

The bevelling edges of canted Stern Timbers.—To obtain the shape of the "bevelling edge" of one of these timbers, we must discover the traces of a plane parallel to the moulding-edge plane, and at some convenient fixed distance from it, say the mean siding of the timber. In Figs. (28) and (29) we have reproduced the traces B and B' of the moulding-edge plane of one of the timbers given in the former diagram, together with the projections $c\,d\,u$, $c'\,d'\,u'$, and the true shape $C\,D\,U$ of that edge. To find the traces of the plane of the corresponding bevelling edge, draw through the point in which the knuckle line cuts the moulding edge a plane perpendicular to the horizontal trace of the moulding-edge plane; $d\,o$ will be a portion of the horizontal trace of such a plane, and will also be the base of a right-angled triangle of which $d'\,p'$ is the perpendicular, and the line intercepted between the point (d, d') in the knuckle and the trace B, is the hypothenuse. Set off from p' (Fig. 28) $p'\,O$ equal to $d\,o$ (Fig. 29, and draw $d'\,O$, then $d'\,p'\,O$ is the right-angled triangle in question rabatted, and the angle $d'\,O\,T$ is the inclination of the plane of the side of the timber to the horizontal plane. Draw from O perpendicular to $d'\,O$, $O\,q$ equal to the mean siding of the timber, and from q draw $q\,r$ parallel to $O\,d'$; then set off from o, and perpendicular to B (Fig. 29), the distance $O\,r$, and through the point r draw B_1 parallel to B, then B_1 is the horizontal trace of a plane the perpendicular distance of which from the moulding-edge plane is $O\,q$. To obtain the corresponding vertical trace, set off on $L\,T$ (Fig. 28) $p'\,s'$ equal to $p\,s$, that being the distance between the planes measured along the axis, and draw through s', B_1' parallel to B'. Having obtained these traces, we may find the projections of the bevelling edge first on the horizontal, and then on the vertical plane, just as we found those of the moulding edge. Or, we may obtain the horizontal projection by observing that the distance between the projections of the two edges, measured square to the lines B and B_1, is the same at all the level lines, and is equal to $o\,r$. The vertical projection is found at once from this, by the simple transfer of breadths to the corresponding lines. These projections between the knuckle and level line III are (e, h) and (e', h').

It must be observed now that in the *rabatment* the bevelling-edge plane will not turn about its own trace B_1' but about the trace B' of the moulding edge; and we have to suppose that the two planes with the lines traced upon them are rigidly connected, and maintain their relative

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FIG. 28.

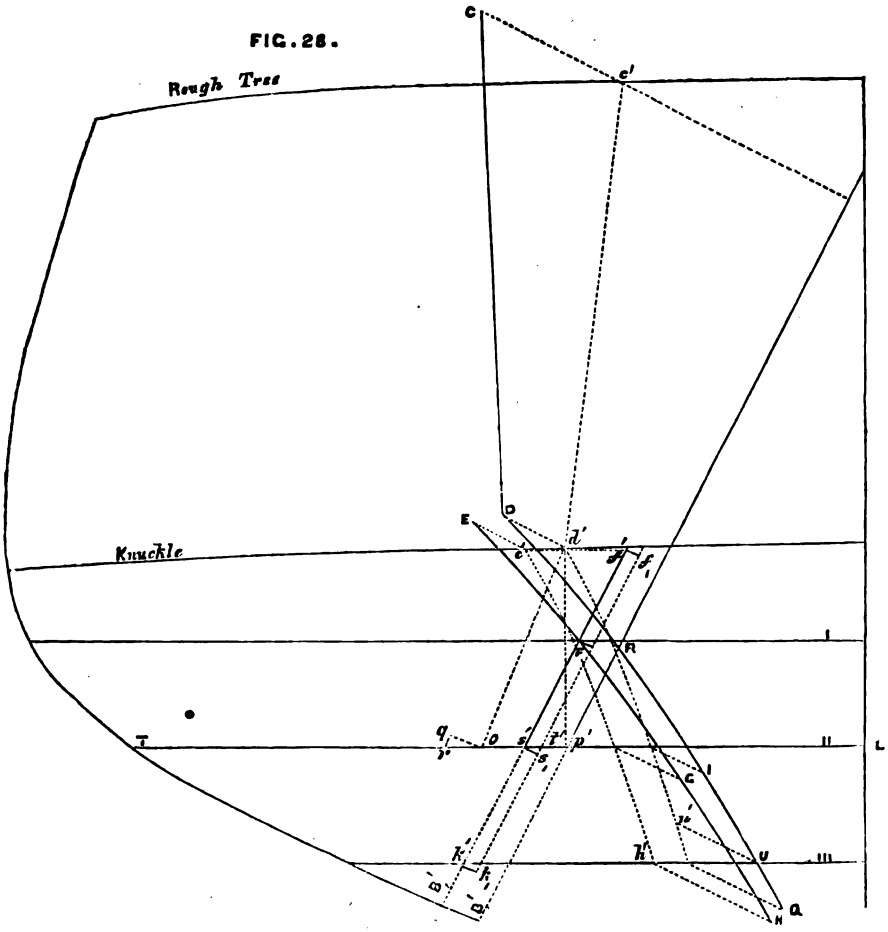
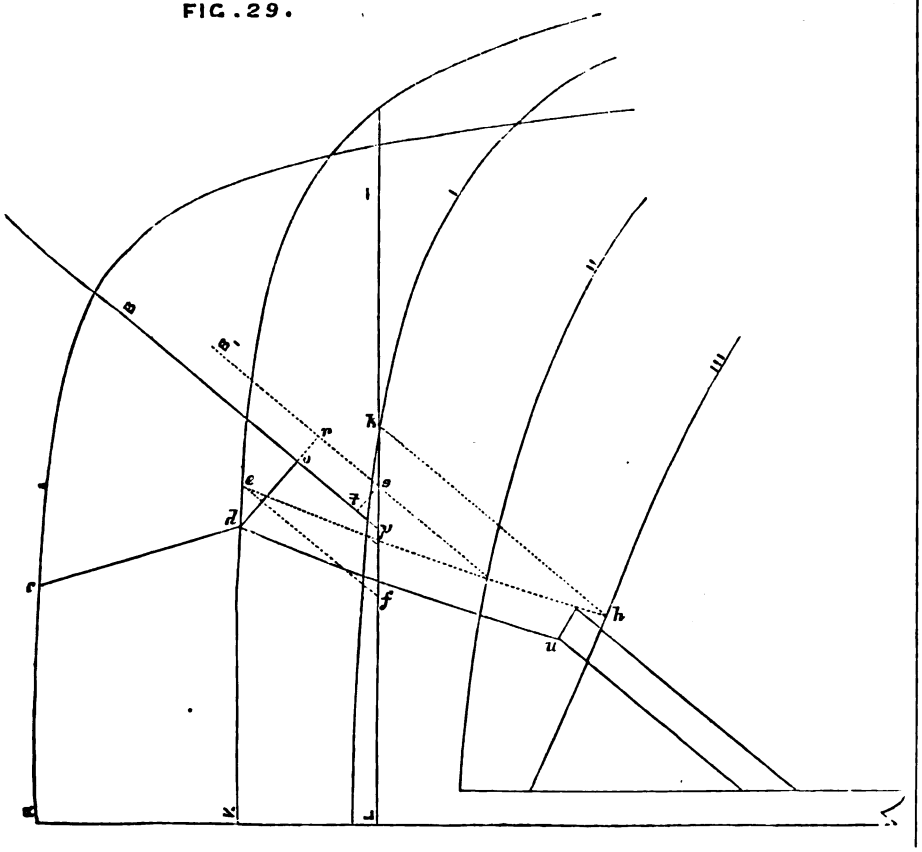


FIG. 29.



positions during the revolution. Those lines which are traced upon the moulding-edge plane will fall *upon* the vertical plane of projection, while the bevelling edge will have to be *projected* upon that plane—in its true shape, however, since the planes are parallel. The effect of preserving this rigid connection will be, that if at any point the timber is square across, the two edges will coincide or cross at that point, and the distances between these edges at other points will enable us to discover the departure from the right angle or "square." Keeping this in view, let us endeavour to delineate the vertical projection, and therefore the true shape of the bevelling edge *after* the revolution, (e', h') being its projection before the revolution. It will be clear that in the revolution, the points in the bevelling edge, and in the trace of its plane at the knuckle and level lines, will move in lines at right angles to B', therefore draw such lines e' E, h' H, &c., and for the trace k' k_1, s' s_1, &c.; f', on the same level as e', being the point to be dealt with at the knuckle, because we only know the *level* distance of (e, e') from the trace. We know that e f (Fig. 29) is the level distance between (e, e') and the trace of the bevelling-edge plane before the revolution, and must be so after it. We know, moreover, that if we draw s t (Fig. 29) at right angles to B, pt will be the level distance between the moulding-edge trace and the projection of the bevelling-edge trace after the revolution. We must therefore set off from f_1, the new position of (f, f'), f_1 E equal to f e. So also we must set off from k_1 the new position of (k, k'), k_1 H equal to k h, that being the invariable level distance between (h, h') and the trace of the bevelling edge plane. Obtain similarly the points G and F, and join E, F, G, and H; the curve so found is the true shape of the bevelling edge projected upon the moulding edge plane. To obtain from these lines the bevelling at level line II., for example, measure the shortest distance from the point I to the bevelling edge, and this will be the distance from a square in the breadth Oq; or it will be the base of a right-angled triangle, the perpendicular of which is Oq, and of which the exterior angle between the hypothenuse and the base is the bevelling to be set off square to the moulding edge at the height of the level line. The corresponding bases for the other lines are found by measuring from Q, R, and D to the bevelling edge, the perpendicular Oq being the same in each case. All the bevellings in the timber we have taken are "standing," and very large, much larger than could be admitted in practice; from which we should infer, as we said at the outset, that the heel of the timber is too far in.

The stern above the knuckle is usually a portion of a conical surface, of which the moulding edge of the timber is a generating line. When this is so, the bevellings at and above the knuckle are all alike, and it is only necessary to obtain that at the knuckle, and as the section of that conical surface by a plane parallel to the moulding-edge plane, *i.e.*, by the assumed bevelling-edge plane, would be a curved line which could only be determined by level lines between the knuckle and the rough tree, it has not been determined. When the timber falls upon the quarters beyond the extent of the conical surface, it will be necessary to obtain the bevellings at the harpins above the knuckle, for which purpose the same operations would have to be performed above the knuckle as have been performed below.

We may now give in general terms the rule for laying-off a canted stern timber in the way proposed.

TO LAY OFF STERN TIMBERS AS DOUBLE CANTS.

Rule.—In the half-breadth plan draw just before the knuckle a line, which we will call the *horizontal axis*, at right angles to the middle line, to determine the position of the vertical plane. Choose that one of the level planes for the horizontal plane which lies nearest to those heads of the lower timbers upon which the stern timbers are to abut, and call the corresponding line, *i.e.*, its trace in the body, the *vertical axis*. Produce the moulding edges of the timbers in both the half-

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breadth and body from the knuckle to these axes, and measure along the *vertical axis* the distances of the intersections from the middle line. Set these off in the half-breadth at right angles to the middle line to find corresponding points in the produced moulding edges. Through the points so obtained draw straight lines at such inclinations as will be consistent with good conversion, and will bring the heels of the timbers in desirable positions, remembering that where these lines cross the level line in the half-breadth corresponding to the *vertical axis* the edges of the respective timbers will also cross it. Measure the distances from the middle line at which the *horizontal axis* is crossed by these lines, and set them off from the middle line on the *vertical axis*. Draw parallel to each of the said lines in the half-breadth, and from the point in which the corresponding moulding edge crosses the rough tree, a straight line meeting the *axis*. Draw also in the body short level lines at the heights at which the moulding edges cross the rough tree, and set off upon them the distances from the middle line of the corresponding points just obtained on the *horizontal axis*. Join these new points with those related to them, and which are already set off on the *vertical axis*. These two sets of lines are those in which the planes containing the moulding sides of the timbers cut the two new planes of projection.

Thus far we have been able to deal with all the timbers together, we must now take each separately. To obtain the projection of one of the moulding edges in the half breadth set off along the *horizontal axis* the distances from the middle line in the body plan at which the intersection of its plane cuts the several level lines. Measure the shortest or perpendicular distances of these points from the intersection of the moulding-edge plane in the half-breadth, and set them off square to this intersection at the corresponding level lines. The points thus obtained are in the horizontal projection of the moulding edge.* Points in the vertical projection of the same edge may be found by transferring the breadths to the level lines in the body. From these new points in the body draw out liftings square to the intersection of the moulding-edge plane. Then on these liftings, and from points in the intersection at the heights at which the edge of the timber crosses the respective level and sheer lines, set off the distances from the *horizontal axis* of the intersection of the edge of the timber with these level and sheer lines in the half breadth, measuring parallel to the intersection of the moulding-edge plane. Join the points so found, and we have the true shape of the moulding edge.

To bevel the timber.—Draw from the projection of the moulding edge at the knuckle, a line square to the intersection of the moulding-edge plane in the half-breadth, and square to the *axis* in the body. From the foot of the line in the body set off along the *axis* the length of the line in the half-breadth, and draw the third side of the triangle of which these form two sides. From the foot of this third side, and square to it, set off the thickness of the timber, and draw to the *axis* a line from the point so found parallel to the third side of the triangle. Measure the portion of the *axis* intercepted between this last line and the foot of the third side of the triangle. Then draw in the half-breadth a line parallel to the intersection of the plane of the moulding edge, and at this perpendicular distance from it. This line will be the intersection of the plane of the bevelling edge. This same distance being also set off at the knuckle and level lines, from the horizontal projection of the moulding edge, and square to the intersections of the planes, will give points in the projection of the bevelling edge. Transfer these to the body and draw out liftings from them square to the intersection of the plane of the moulding edge. Then set off from this intersection and along the *axis* the two distances between the intersections of the moulding and bevelling-edge planes, one measured along the *horizontal axis* and the other square to the intersections. Draw lines through these points parallel to the intersection. Square in from the outer to the inner of these lines the points in the former, which are at the heights at which the projection of the bevelling edge crosses the knuckle and level lines. From the points thus found on the inner line set off on the liftings the distances from the *axis* of the horizontal projection of the bevelling edge at the knuckle and level lines, measured parallel to the intersections of the planes of the sides. By joining these points the shape of the bevelling edge below the knuckle is obtained. If the sides of the timber lead up to the apex of the cone, all the bevellings above the knuckle will be the same as that at the knuckle, because the two outer edges of the timber are in one plane, or, viewing it in another way, because the moulding edge of the timber lies in a tangent plane to the surface.

* By conducting the operations up to this point for all the timbers we may complete with certainty on the drawing the disposition of the stern frame in the half-breadth. In laying-off the ship subsequently, the draftsman will be able, by reversing the latter part of these proceedings, to discover the planes of the edges, and to conform to the arrangement, an advantage which the ordinary method does not possess.

Literature.

A Practical Treatise on the Manufacture and Distribution of Coal-Gas, its Introduction and Present Improvement. Illustrated by Engravings from Working Drawings, with General Estimates. By SAMUEL CLEGG, Jun., M. Inst. C.E., F.G.S. Third edition, greatly enlarged, and with numerous additional Illustrations. London: John Weale, 59 High Holborn. 1859.

IT affords us pleasure to find that this standard work on coal-gas, by the late Mr. Clegg, has suffered nothing in this its third edition from the decease of the author. The present volume has been remodelled and considerably extended, with the view of bringing its information down to the present period, by gentlemen very competent to perform the task. We must say, however, it is scarcely as complete as it should be. We ought in a work like this to have seen some mention, at least, made of such apparatuses as Chadwick and Frost's gas meter, Hart's regulating burner, &c. Where so many modern improvements are recorded, these should not have been altogether omitted.

The Principles and Practice of Harmonious Colouring, in Oil, Water, and Photographic Colours, especially as applied to Photographs on Paper, Glass, and Silver-Plate. By an ARTIST-PHOTOGRAPHER. Second Edition. London: W. Kent and Co., 51 and 52 Paternoster-row; and J. Newman, 24 Soho-square. 1859.

THIS is a very useful and able book. The author is master of his subject, and writes exceedingly well. His publishers have seconded his efforts by getting the little volume up in a very neat and tasteful manner. Its price is marvellously low.

Remarks on Coinage; with an Explanation of a Decimal Coinage proposed to be introduced into this country. By "JACIA." London: Simpkin, Marshall, and Co. Birmingham: R. Mathison, 71 Edgbaston-street. 1859.

IT has been stated in these pages on several occasions that the decimal system has not yet been fairly placed before the public, and that partisanship has much interfered with a fair consideration of the subject. Those opinions we are prepared to re-assert, and we hail, therefore, with much satisfaction the appearance of a pamphlet which, setting aside some lame attempts at wit at the expense of other advocates of decimalisation of coinage, appears dispassionately to consider the whole question, and to set forth a new proposition. The writer of "Remarks on Coinage," &c, seems to have given a considerable amount of attention to the subject upon which he descants, and there is little doubt that he has mastered many of its difficulties. He alludes to the simplicity of the decimal system of accounts, and very properly remarks upon the saving of time which would of necessity be effected in schools were the rules of arithmetic worked on the decimal plan. It is certain, too, that men of business would soon discover the advisability of adopting it entirely were they but to try it. We are aware it has been objected that by the introduction of the decimal system of account keeping, the demands for clerical assistance would be lessened, and that clerks and bookkeepers would soon be at a discount in the market. So far, however, from recognising this as an argument *against* decimalism—if we may coin a word—we adduce it as a reason for its introduction. It is rather too late in the day to object to a thing because it lessens labour and saves time, and any attempt to prove the contrary proposition would indeed be but a waste of both labour and time. All our efforts at improvement, whether in a mechanical or scientific direction, are levelled to effect the economisation of both, and it would be folly to think of doing anything else.

The author of the work in question next advances the all-important problem—how can we "graft" a decimal coinage on £ s. d.? He refers to the systems working in France, America, and other countries, and after making some perforations therein, proceeds to propound his own plan, which he considers superior to either. "The number of subdivisions, or intermediate coins, is immaterial; but should neither be inconveniently small nor confusedly large. The highest coin should be made of gold; the lowest of copper; and the others of gold, silver, copper, or bronze, as is found most convenient." The *pound* and *mil* scheme "Jacia" condemns, because it would entail, as he considers, a loss on the holders of copper coins. "The *farthing* being found a very useful coin (?), quite low enough in value and small enough in size, has been chosen for my basis, or starting point. Including *that* there would be four 'leading coins,' the 'unit of account' will be worth 1,000 farthings; the next leader 100; and the third, 10. I name these from the Latin numeral adjectives, the Mille (1,000), or Millea, the Centum, (100), the Decem (10), or Denny, and the Unum (1) or farthing; these names to be in the plural, Milles, or Milleas, Centums, Decems or Dence, and Unums; or, if preferred, the term farthing, as regards the last-named might be retained." The writer then proceeds to demonstrate the little inconvenience with which such a change might be effected, as he thinks, and the great advantage which must arise from it. Into his elaborate tabular explanations, however, space forbids us to go. It will be sufficient to say that "Jacia" gives some potent reasons for adopting his own scheme, and whilst urging a conviction of its superiority, concludes his noteworthy and clever contribution to the decimal controversy by asserting that he has "weighed the advantages and disadvantages of a decimal coinage, and found the latter to be as dust in the balance compared with the former." For ourselves, we may say that we are as strongly impressed as "Jacia" with the necessity of so great a social reform as the introduction of a good decimal system would inevitably effect, and that we are glad to find the meeting of the "INTERNATIONAL ASSOCIATION FOR OBTAINING A UNIFORM DECIMAL SYSTEM OF MEASURES, WEIGHTS, AND COINS," at Bradford, has resulted in a series of resolutions, supported by some of the leading men of the time, in favour of such a change. The "final report" of Lord Overstone, repudiated as it was by Lord Monteagle, and notoriously one-sided, ought only to excite yet further the advocates of the decimal system to renewed exertions with a view to "final" triumph. It is possible, nay, probable, that next week we may devote more time and space to the subject, aided, as the cause has been, by the elicitation of further light from the assembly of *savans* at Bradford.

LIST OF NEW BOOKS.

Barns's Designs for Mansions, Pillars, &c. Parts II. to VI., 2s. 6d. each.
Cotton's Phthisis and the Stethoscope, 2nd edit., 3s.
Fison's Handbook of National Association of Social Science, 2s. 6d.
Harrison's Treatise on the Culture of the Vine.
Thomson's Tables of Interest, at 3, 4, 4½, and 5 per cent., 17th edit., 3s. 6d.

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ON A SUBMARINE LAMP.

By Mr. Rettie.*

The submarine lamp is intended chiefly for using under water, for throwing light upon objects in the beds of rivers, or in the depths of the sea, applicable for the examination of the foundation of piers and bridges, and of the hulls of vessels while afloat, also for the purpose of attracting fishes and other residents in the deep, &c.

In the construction of the submarine lamp various points had to be attended to, as essential to its success.

1. The obtaining of a powerful light by a lamp of limited dimensions and perfectly water tight.

2. Whilst adapted for using near the surface, to be capable of extending with facility, and of strength sufficient to sustain the pressure of water, when immersed to any considerable depth.

3. The entire removal of air vitiated by the flame, and introduction of air capable of supporting combustion.

These having been severally attended to, the object has been satisfactorily attained by the lamp shown.

The lamp may be made either of a globular or cylindrical form (if the former it will require to be of glass), the bottom being made of brass, with a large screwed opening for the admission of the argand burner used; on the top of the globe is a brass cap, into which is screwed a strong copper tube, in the centre of which is fixed another tube, one-fourth less in diameter, and so fixed that air may pass freely in the space between the two; the lower end of this inner tube has a trumpet-shaped termination which enters into the globe, reaching within two inches of the top of the chimney of the argand burner of the lamp. The upper ends of the tubes terminate in a sort of lantern top, which is divided into a lower and upper compartment; from the lower compartment, the larger (or upper) tube conveys the air required by the lamp for effecting combustion, while through the upper compartment is discharged by the inner or centre tube the vitiated air, as ejected from the lamp.

The principle on which the lamp is constructed and depends for action, is that arising from the discrepancy of the gravity of the two columns of air necessarily engaged, viz., the column of cold for supplying combustion, and the column of heated air ejected. And in the arrangement of the tubes, advantage is taken to foster the peculiar qualities of the respective columns; thus, the cold being made to descend by the larger and outer tube, whose surface is exposed to the action of the water, while the heated or centre column is placed immediately over the powerful burner of the lamp.

COILED ELECTRIC CABLES:

being "Remarks on the Discharge of a Coiled Electric Cable," by Professor W. Thomson.†

Mr. Jenkin had communicated to the author during last February, March, and April a number of experimental results regarding currents through several different electric cables coiled in the factory of Messrs. R. S. Newall and Co., at Birkenhead. Among these results were some in which a key connected with one end of a cable, of which the other end was kept connected with the earth, was removed from a battery by which a current had been kept flowing through the cable, and instantly pressed to contact with one end of the coil of a tangent galvanometer, of which the other end was kept connected with the earth. The author remarked that the deflexions recorded in these experiments were in the contrary direction to that which the true discharge of the cable would give, and at his request Mr. Jenkin repeated the experiments, watching carefully for indications of reverse currents to those which had been previously noted. It was thus found that the first effect of pressing down the key was to give the galvanometer a deflexion in the direction corresponding to the true discharged current, and that this was quickly followed by a reverse deflexion generally greater in degree, which latter deflexion corresponded to a current in the same direction as that of the original flow through the cable. Prof. Thomson explained this second current, or false discharge, as it has since been sometimes called, by attributing it to mutual electro-magnetic induction between different portions of the coil, and anticipated that no such reversal could ever be found in a submerged cable. The effect of this induction is to produce in those parts of the coil first influenced by the motion of the key a tendency for electricity to flow in the same direction as that of the decreasing current flowing on through the remoter parts of the coil. Thus, after the first violence of the back flow, through the key and galvanometer, the remote parts of the cable begin, by their electro-magnetic induction on the near parts, to draw electricity back from the earth through the galvanometer into the cable again, and the current is once more in one and the same direction throughout the cable. The mathematical theory of this action, which is necessarily very complex, is reserved by the author for a more full communication, which he hopes before long to lay before the Royal Society.

* Abstract of British Association Paper, 1859.

† British Association, Section A, 1859. *Athenæum.*

THE GREAT EASTERN.

To the Editors of the "Mechanics' Magazine."

Gentlemen,—The data on which your application of the Admiralty formula to the speed and performance of the Great Eastern is founded are, I fear, imperfect. The power which drove the ship at the alleged speed of 15 knots an hour, you take at 7,200 horses. At the only time when the ship went 15 knots an hour, or near it, the sails were supplying a good deal of propelling power, in addition to the indicated steam-power of 7,200 horses.

I hope you will endeavour to have the subject well ventilated in your journal. All the facts connected with or bearing upon the performance of this ship ought to be made well known, and they ought to be thoroughly discussed.

There is no doubt but that the speed of the ship will disappoint public expectation, and there is a great danger of mystification leading many people to imagine that there is no use in making steam-ships of very large dimensions. To counteract this misapprehension it ought to be made more known than appears to be the case at present that the Great Eastern is not designed for high speed —Mr. Brunel designed her for carrying a very large load of coal, and her great size enabled him to obtain *as good* a speed as that of fast smaller vessels, notwithstanding the large load of coal.

Whether the scheme be sound commercially is a separate question altogether from that of what the performance of a large vessel compared with a small one may be.

One test of the importance of a large scale in obtaining speed would be to calculate what would be the probable performance of a *reduced* Great Eastern.

It is to be hoped that unreasoning disappointment at the speed of the Great Eastern may not enable that active and energetic body, the proprietors of existing slow steamers, who abhor progress, to propagate the impression that large steamers are a mistake.

I want to see one upon my bosom which will carry crowds of tourists between America and Europe at the rate of at least 25 miles an hour.

Your obedient servant,

Atlantic.

17 October, 1859.

P.S.—What is wanted is an Atlantic ferry steamer of the length and nominal power of the Great Eastern proportioned and formed for speed; such a ship would necessarily include comfort.

[We do not believe that the sails added anything considerable to the speed of the Great Eastern. It would require an enormous spread of canvas, and a very strong breeze, to add much to the speed of a ship going at the rate of, say, 14 knots an hour. —Eds. *M.M.*

Gentlemen,—The Great Eastern steamship is no doubt a great success in many points of view, but making every allowance for disadvantageous circumstances during the late trial, we must not attempt to conceal from ourselves that expectations have not yet, at least, been realised in regard to the superior speed which was anticipated from her fine lines and immense size. It was certainly hoped that the combination of these two elements would have inaugurated a new era of velocity in maritime conveyance. Of course I do not allude to absolute velocity, procured by an indefinite expenditure of fuel, but a velocity in relation to the power employed; and which both experience and science inform us ought to proceed in some increasing ratio with an increase of size, when accompanied with a corresponding employment of power.

No doubt if we take burden or transport capabilities into the calculation, there is not much cause for disappointment, for the formula in which the displacement of the ship is involved gives, as you observe, the high number 316 as the co-efficient of its dynamic performance; whereas Mr. Atherton assigns for the standard of high efficiency in this respect only the number 250. In this aspect, therefore, of mercantile transport in combination with speed and power, and involving therein commercial success, the Great Eastern is complete. This was to be expected from her great size and her great length in proportion to width, whereby resistance, both from the translation and the friction of water, is reduced in a ratio to burden, to a degree far beyond anything hitherto attempted. But considering her as a passenger vessel, in which, as in express trains, velocity, independent of transport, is the object exclusively valued, her performance, as yet, at least, is even inferior to what has been already accomplished. The inference is, that no great improvement is apparent as the result of *form* in combination with size, apart from the influence in the proportion of length to width upon that form, but which is not necessarily productive of fine lines.

The formula to test efficiency in this respect and the value of form is undoubtedly that in which we substitute the midship section for the displacement. The highest number which you give in reference to several of our war steamers is in the case of the Miranda, the efficiency of which is denoted by the figures 780.* Now, taking the speed of the Great Eastern at a certain period of her trial at 15 knots; her midship section at 1,588 feet; and the horse-power then developed at 7,200—in which assumption the first and last items are, according to the *Times*, too favourable —the number indicating performance is only 744; and if we knew what the Himalaya and the Persia accomplish, the comparison, it is to be feared, would be yet more unfavourable. Now, as the *form* is certainly not faulty, and as it can by no means be admitted that it could possibly neutralise the other proved advantages derived from proportion and size, even though it did not add thereto, we are, I think, authorised to make this further inference, that her capabilities in regard to velocity have not yet, for some cause or other, been fairly developed. This is a more probable conclusion than that other vessels have been built after a better type.

In regard, indeed, to absolute velocity, it is not at all unlikely that her speed will ultimately be 18 knots; but the scientific and economical question would still remain, whether, with such velocity, the dynamic performance in relation to the power employed would be then improved. We may expect that it will, inasmuch as with a deeper immersion the slip of the propeller—the amount of which we have not been informed—may be lessened, and the slip of the paddle-wheels, amounting now to 14 per cent., would certainly be reduced. Asking simply for information, may I inquire whether, at the best, this slip is not likely to be too great, and to be a constant needless

* This, as most of our readers doubtless inferred from the context, was a printer's error. It should have been 680. —Eds. *M.M.*

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source of loss of velocity, seeing that the area of the twelve immersed floats is not one-third of the area of the midship section. Is this proportion in accordance with the usual practice? Would it not be well to give the floats increased depth? Does the fault lie here for deficiency of performance as determined by the midship section.

It will, however, be in stormy weather—occupying, by-the-bye, a great portion of the year—that both the absolute and the economic speed will be found to be most conspicuously in favour of the Great Eastern, for a heavy sea will be no impediment comparatively to her progress. Under these circumstances her superiority to any vessel, which though in fair weather may be equal to herself in velocity, will be seen to be very great, in respect merely to speed.

I am, Gentlemen, yours,

BENJ. CHEVERTON.

[Our correspondent forgets that a very small (comparative) amount of engine-power has been given to the Great Eastern. Only newspaper writers ever taught the public to expect any very high speed from her. As to the indicated horse-power being understated in our article according to the *Times*, we admit it may have been, although 7,200 was the number given to us by one of the very few persons who had an opportunity of learning what it was—a person who would have exaggerated nothing in the ship's favour. But even if we take 7,800 horse-power—a number since put forth as the proper one—we still get 692 and 292 for the Great Eastern's constants, one of which is much higher than that of any ship of the Royal Navy, while the other is equalled by only four vessels of that navy.—EDS. *M.M.*]

CONSTRUCTION OF SCREW PROPELLERS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN.—Your correspondent, Mr. Hewitt, may study this subject still further with advantage to himself. In answer to his questions I would say, we *do* find a curve or twist imparted to the vanes of a windmill, technically called weathering; and the reason of its omission in the smoke-jack and in flying-tops is, because power is abundant and economy of construction is an object. I once made a flying-top with a perfect screw form, and it was very effective; I did not attempt a comparison with others, because a fair conclusion could not be drawn, but it satisfied my then boyish philosophy, that the perfect screw was the best even for that unimportant article.

I should weary your readers if I pointed out the the disadvantages of a *flat* surface screw; they are obvious to the reflective mind, the floundering tendency being all on the side of that false construction.

A screw propeller acts upon a solid cylinder of water; the more perfect the cylinder, the better the screw is *fed*, and the less will be the vibration; but we must have a stern-post, and the stern-post must have some thickness; this interferes with the perfection of the cylinder of water, inpairs the *feed* of the screw; consequently the screw at every half revolution arrives at a *vacuum*, an interruption in its fulcrum; hence it travels past the wake of the stern-post with a jerk, which communicates a tremulous motion. I believe that there is often a perfect vacuum formed abaft the stern-post, the water passing several inches aft on each side before it meets.

Griffith's screw having a large boss tends to correct the evils arising from the imperfect cylinder of water, but its *flat*, unscrewlike surface is a drawback. Its entrance into the vacuum above-mentioned being confined to so small a surface at its forward end, and its greatest diameter being well aft the stern-post, and being without radial edges, vibration is almost prevented.

I think much good may be accomplished in lessening vibration by thinning off the after edge of the stern-post as much as possible, in the same manner as you stated, some time since, the forward edge of the rudder-post has, with advantage, been served. Of course, close to the axle it is immaterial, but above and below the centre of the propeller shaft it may be easily done.

I am, Gentlemen, your very obedient servant,

T. MOY.

Clifford's Inn, Oct. 17, 1859.

AN EXTRAORDINARY CABLE.

MESSRS. BROWN, LENOX, & Co., of Millwall, the manufacturers of anchors and cables for the Admiralty, have just completed upwards of forty fathoms of what is probably the largest cable that ever was made. It is to be used for mooring the large floating coal-ship in Malta harbour, and is of sufficient strength to hold it with a line-of-battle steam-ship lashed on each side of it, in the roughest weather. The employment of this cable will therefore enable the largest ships of war to come up to the depôt and coal without casting anchor, and steam away to give place to others directly they have taken in their supplies. This facility would be very valuable in time of war. The cable is formed of 4½ inch iron, with links 27 inches long, each link weighing no less than 2 cwt. 3 qrs. On Wednesday last we attended the works and saw this enormous cable tested under the supervision of Mr. Willcocks, the master smith of H.M. Dockyard, Woolwich. Mr. G. Cotsell, the master smith of Chatham Dockyard, being also present. By an admirable arrangement of combined steam and hydraulic apparatus, devised by Mr. W. Roberts, the foreman of the works, the pressure was run up to the maximum testing strain of 187½ tons in a very few minutes, the cable sustaining it without affording even the slightest evidence that it was being subjected to such a high degree of tension. This, however satisfactory, was not surprising, inasmuch as the cable is supposed to be capable of bearing twice the test-strain without injury. The small steam engine which works the hydraulic apparatus is so arranged as to do all the heavy work of pulling the cables on to and off the testing platform, and afterwards to run them out to the wharf for shipment.

Our Weekly Gossip.

MR. ATHERTON asks to have the following letter inserted:—

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—It is gratifying to me that you approve of the general tenor and purport of the paper presented by me to the British Association at their late meeting at Aberdeen, and that your ideas of its public utility have induced you to insert it with editorial remarks in the MECHANICS' MAGAZINE of the 14th inst.; but in your thus bringing the subject of "Mercantile Steam Transport Economy as affected by the Consumption of Coals" before the notice of your readers, I regret that you have reverted, in terms which I may not altogether overlook, to our former and closed discussion on the deficiencies of our legislative system of tonnage and engine power registration, which subject has nothing to do with my present paper. In my discussions with yourself as editor of the MECHANICS' MAGAZINE, I have always felt that some latitude must be allowed for the necessity which constrains editors of public journals to be somewhat spicy in their dishing up of rather heavy materials for the public taste. In common, therefore, with your other readers, I enjoyed the raciness with which, though at my own expense, you excited public interest in the tonnage and horse power registration 'questions; but as in your present editorial remarks you again concede the great points for which I formerly contended, viz., that "builders' tonnage" and "nominal horse-power" are no measurement at all of the capability of ships to carry weight, or of the working powers of engines; that in shipping affairs the terms recognised by the legislature are repudiated by science; and as it was to expose this state of things and its consequences, in respect of which you now observe "all calculations based on this principle are delusive," that my former efforts, which you are now pleased to designate as "frantic invocations," were directed; moreover, as my papers thus designated by you as "frantic invocations," and in regard to which you now congratulate me that "a change has come over the spirit of my dream," were honoured with the medal of the Society of Arts, and have for three successive years been received by the British Association for the Advancement of Science, and for three successive years been ordered by the Council to be inserted in full in the annual volume of its transactions—under these guarantees for the public utility and general propriety of my papers I leave it with your readers to judge of the suitableness or otherwise of the choice terms which you now address to me, and of your taste in the present application of them on my having written a paper which you do approve. Publicly and practically it is a satisfactory result of the discussion referred to that the deficiencies of our shipping and engine-power registration have been exposed, and that in consequence of this exposure shipping affairs, as respects the dynamic performances of steam-ships, are now being generally investigated with reference to displacement and indicated powers, to the exclusion of builders' tonnage and nominal horse-power, the recognition of which change has already opened people's eyes and rendered steam-ship construction subject to competitive rivalry conducive to progressive improvements, from which great public benefit will undoubtedly result—I am, Sir,

Your very obedient servant,

CHAS. ATHERTON.

Woolwich Dockyard, 18th Oct., 1859.

Mr. Atherton is so welcome to any advantage which such a letter as the above can bring him, that we shall not take the trouble to reply to what he says in it, although we dissent—let it be understood—from several statements and implications contained in it. Any one who will take the pains to compare his first paper on shipping registration with his last will see both how necessary severity on our part was, and how beneficial it has been. Mr. Atherton seems to think that the award of a medal by the Society of Arts, and the printing of a paper or two by the British Association, are sufficient to prevent the criticism of a scientific journal from taking effect. But what nonsense this is! If Mr. Atherton should contrive to cover himself from head to foot with a perfect mail of medals, would he be thereby protected from the shafts of reason and truth? It was not, however, because of his "frantic invocations" that he had a medal awarded him; it was in spite of them, as he should have sense to see. If he will accept our advice he will let bygones be bygones, and confine himself to the good work on which he has at last fairly entered, and in which he shall have our best support.

Orders were received at Portsmouth late the week before last to fit Her Majesty's ship Urgent with Cunningham's patent reeling gear. In consequence of the artificers of the Dockyard having been so recently employed in getting ready the steam flotilla for China, the fitting of the yards and sails was undertaken by Mr. Cunningham. The yards were sent into the Dockyard on Monday last, completely fitted, and will be crossed so soon as the Urgent can get alongside the wharf.

In Mr. Moy's letter on aerial navigation in our last number, there is an error. "A hundred miles an hour would be 1,800 feet per minute." It should have been 8,800 feet per minute.

Mr. J. H. Greatrex, the well known scientific photographist of 70 Regent Street, impressed with the many lives that are yearly sacrificed by fire—in many cases, according to his notions, perfectly preventable—has completed a model by which he suggests a mode of easy escape from a house under almost the worst phases of a conflagration. The plan is simply to build to those houses already erected an outward perpendicular shaft, in which cross step-pieces as a ladder are inserted. This shaft he would communicate with each landing by swing iron fire-proof doors; and with those buildings not already erected he proposes to leave to the architect the carrying out of his patent so long as the main features of the principle are held in view. Mr. Greatrex invites the inspection of all those interested in the discovery of some really practical means of rendering our dwellings secure at least from the loss of life, and we consider that he deserves every credit and encouragement for thus devoting his practical mind to a subject so vitally important.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, payable in advance. Post Office Orders to be made payable to R. A. BEECHAM, at the Post Office, Fleet Street, London, E.C.

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

Steam Engines, &c., 728.

Boilers and their Furnaces, &c. *None.*

Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 724, 727.

Ships and Boats, including their fittings, 677, 705.

Cultivation of the Soil, including agricultural and horticultural implements and machines, 693, 706, 726.

Food and Beverages, including apparatus for preparing food for men and animals, 676, 679, 688.

Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 673, 684, 701, 704, 709, 721, 729.

Buildings and Building Materials, including sewers, drain-pipes, brick and tile machines, &c., 678, 696, 714.

Lighting, Heating, and Ventilating. *None.*

Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 695, 699, 718, 719.

Metals, including apparatus for their manufacture, 681, 690, 691, 697, 703, 707.

Chemistry and Photography *None.*

Electrical Apparatus, 687, 716.

Warfare, 685, 725.

Letter Press Printing &c., 710.

Miscellaneous, 674, 675, 680, 682, 683, 689, 692, 694, 698, 700, 708, 711, 712, 713, 715, 717, 720, 722, 723.

673. C. Garnett. "Improvements in machinery for ginning cotton, and for cleaning cotton and certain other fibrous materials." Dated March 17, 1859.

This consists, 1, in a mode of securing the toothed wire to the cylinders or toothed rollers of cotton gins or other machines, and in the application of an improved clamp through which the wire passes when being wound on the roller. 2. In applying wheels and pinions to the toothed roller cotton gins for increasing the speed of the working parts when turned by hand. 3. In applying suitable self-acting agents to the hoppers of toothed roller, saw, and other cotton gins for rendering them self-feeding. 4. In applying a toothed roller cotton gin to certain opening and cleaning machines in such a position that the seeds or burrs thrown out by the beater or pricker cylinder are deposited in the hopper of the gin by which the fibres are separated from the seeds or burrs. *Patent completed.*

674. J. H. Johnson. "Improvements in machinery or apparatus for folding and stitching sheets of paper." (A communication.) Dated March 17, 1859.

Here the sheets to be folded are laid upon a table, above which is extended, in a horizontal position, a knife or flat blade, which in descending forces the sheet into a slot across the table, and carries it down below the table between india-rubber bands in a doubled state. A second blade in a vertical position then advances and forces the once folded sheet through a second slot which effects the second fold, and lastly a third blade, which is horizontal and at right angles to the last one, completes the third fold, and forces the folded sheet between a pair of pressing rollers, which finally deliver it at the side of the machine. When required, the stitching may be effected immediately before the final fold is made by two needles supplied with thread from a suitable holder, which is arranged to impart the requisite tension thereto. *Patent abandoned.*

675. E. T. Hughes. "Improvements in machinery or apparatus for crushing sugar canes and other materials." (A communication.) Dated March 17, 1859.

The inventor fixes upon a platform a strong framework, having bearings for the shafts of the crushing cylinders, and also for the main driving shaft, which latter is divided in the centre and furnished with two cranks. Upon the shafts of the two lower cylinders toothed wheels are fixed in the usual manner, geared into another wheel on the top cylinder shaft, at the end of which is a large toothed wheel geared into a pinion on the driving shaft, the cranks of which are connected by rods to a double set of compound levers, which are again connected to long levers at each side or end of the apparatus. The aforesaid long levers are acted upon alternately either by hand or power, giving motion to the intermediate levers and cranks, the effect of which is transmitted by means of the gearing to the crushing cylinders which act effectively either by the power of two men or other power. *Patent abandoned.*

676. R. A. Brooman. "Treating barley so as to obtain new alimentary substances therefrom." (A communication.) Dated March 17, 1859.

The inventor first sifts the barley, then pounds or crushes it between peculiarly-formed millstones, then passes it through a bolting machine, then subjects it to the action of a "ventilating" apparatus, then again pounds or crushes it as before, and finally sifts it into two, three, or more parts of as many different qualities. The object is to obtain meal from the grain in great purity. *Patent completed.*

677. T. Skelton. "Improvements in steering apparatus." Dated March 17, 1859.

This relates, 1, to tillers, and, 2, to yokes; and the object in both cases is to avoid the slacking of the steering ropes to improve the steering. The inventor forms in the tiller a slot or a groove in which runs a roller fixed in the middle of a double block. The steering ropes are attached to this block, and lead around a steering barrel in the usual way. As the steering wheel is turned and the helm thereby moved, the roller of the block slides along in the slot or groove in the tiller, so as to prevent the necessity of the length of the rope altering. In the case of yokes the inventor modifies the plan by fitting a rolling block at the end of each arm, the action being essentially the same in both cases. *Patent abandoned*

678. A. G. Hutchinson. "Improvements in counteracting damp in buildings." Dated March 17, 1859.

This consists in the use in the construction of the outer walls of buildings of bond bricks, headers, and bond stones, which are previously rendered non-conductors of damp at one end, and for any required distance down the sides thereof, by the application of any suitable damp and proof material or materials. *Patent completed.*

679. P. Larocheite. "Improvements in machinery for brewing." Dated March 17, 1859.

This invention is not described apart from the drawings. *Patent completed.*

680. A. Mein. "Improvements in making glass bottles, and in the apparatus connected therewith." Dated March 17, 1859.

The patentee uses a mould which is internally of the figure of the bottles to be made. It is split vertically so as to be capable of being opened into two halves; the part which moulds the neck and rim of the bottle points vertically downwards, and contains a hollow cone spindle or nozzle to mould the tube of the neck internally. The mould has also a cover which moulds the bottom of the bottle. The mould being shut laterally, but with the corner off, a proper quantity of glass in a soft state is placed in it; the cover is then put on by hand or by mechanism, and a blast of air is blown by suitable apparatus through the hollow spindle. This swells out the soft glass so as to make it fit the mould, and completes the formation of the bottle. The mould is then uncovered and the bottle taken out. *Patent completed.*

681. A. Warner and W. H. Tooth. "Improvements in the manufacture of iron." Dated March 17, 1859.

Here pig iron is melted in a reverberatory furnace in the presence of hydrogen gas, nitrogen gas, nitrous acid gas, nitric acid gas, or cyanogen gas, obtained by any suitable apparatus, and primary suitable materials, atmospheric air being excluded as much as possible from the interior of the furnace; or the requisite gases may be generated by supplying jets or streams of coal-tar or pitch to the ordinary fuel in the fire place of the reverberatory furnace. The pig iron being melted is then run out and cast into slabs, pigs, or blocks, which on being set or cold are melted and puddled in a puddling furnace. *Patent completed.*

682. J. Donat. "Improvements in apparatus used with matches for obtaining instantaneous light." Dated March 17, 1859.

This is applicable where a length of cotton saturated with wax or stearine or other substance having phosphorus deposited upon it at intervals is used. The length of match is formed into a spiral coil and placed within a cartridge of this metal having an opening at one end through which one end of the match projects. This cartridge is placed within a metal tube, one end of which is formed conically, and at the point of the cone there is a small hole through which the end of the match is passed by means of two rollers. On the exterior of the tubular case another tube of glass metal slides, and when slid up beyond the end of the tubular case prevents the match from being blown out by the wind. *Patent abandoned.*

683. W. Cook. "A smoke consumer." Dated March 18, 1859.

This consists in constructing furnaces or fire-places to which the same may be applied with an opening or aperture at the lower portion or base of the grate communicating with the chimney, so that the smoke, which is prevented from passing into the shaft as at present, is thereby carried downwards through the fire and consumed. *Patent abandoned.*

684. W. B. Taylor. "Certain improvements in or applicable to looms for weaving." Dated March 18, 1859.

This consists of apparatus for applying the dressing to the warp when in the loom. The dressing is supplied to the warp by a brush revolving in a trough, which brush delivers the dressing to a roller furnished with a doctor; the warp passes over this roller and is pressed upon by another roller covered with flannel, &c., and then through two stationary brushes. The warp on leaving the warp beam, or in any place between the warp beam and the healds, passes through one or more reeds, and it is separated by one or more lease rods to keep each warp thread distinct from the others. A fan is applied to cause a current of air to act on the warp threads to dry or partially dry them before they pass through the healds. *Patent completed.*

685. Sir W. G. Armstrong. "Improvements in the means of igniting explosive projectiles." Dated March 18, 1859.

The object here is to cause a shell or projectile to be ignited and exploded on striking an object sideways, or otherwise than endways. The striker is fixed on a bolt which is withdrawn by the shock the projectile receives on the firing of the gun, and being so withdrawn is at liberty to move to one side when the shell or projectile is checked in its flight by striking sideways against an object, the effect of which motion is to break or crush the receptacle of the detonating composition, and to fire or ignite the charge on the shell or projectile falling on its side, or striking with its side instead of its end against an object. *Patent abandoned.*

686. F. Potts. "A combined metallic support and label for training, supporting, removing, and transplanting flowers or trees, in gardens, or green and hot-houses, or for other horticultural purposes." Dated March 18, 1859.

This relates to the construction of galvanised sheet iron sticks for supporting and training flowers. In connection with such sticks a suitable flattened part at the top is employed on which the name of the plant is written. *Patent abandoned.*

687. J. Molesworth. "An improvement in telegraphic communication." (A communication.) Dated March 18, 1859.

This consists, 1, in employing an entire metallic conducting circuit in combination with any known generators of galvanism, electricity, or electro-magnetism, and with any known mode of breaking and closing such circuit at pleasure, and with or without electro-magnets. 2. In using one such generator at every station for the main circuit from which intelligence is to be sent to any other station by means of the said combination, and the same is to be adjusted to the circuit and to the other aforesaid known agencies so as not to have such generator brought into action, except only when intelligence is being transmitted from such station. 3. In employing for such conducting circuit any metallic rod, wire, or cord of any sufficient conducting capacity to transmit the current so generated of the desired intensity and quantity, such wire, rod, or cord not requiring artificial insulation. 4. In employing in the circuit aforesaid any known instrument or mode of recording, marking, or printing signs or letters at each and every station desired. *Patent abandoned.*

688. R. Clegg and R. Fell. "Improved apparatus for obtaining aërated fresh water from salt water." Dated March 18, 1859.

This apparatus is composed of five parts, viz., a generator or condenser, a vacuum chamber, an air pump, and a closet-tank. We cannot devote space to a description of the operation of the apparatus. *Patent abandoned.*

689. J. Hinks and G. Wells. "A new or improved penholder." Dated March 18, 1859.

This consists essentially of two hollow cylinders or tubes, fitting one upon the other, the inner tube being elastic and the outer tube inelastic. There are various details included. *Patent abandoned.*

690. R. Mushet. "A new or improved metallic alloy." Dated March 18, 1859.

This consists in melting deoxidised wolfram or deoxidised tungsten with a triple metallic compound of iron, carbon, and manganese, so as to produce by the fusion together of these substances a metallic alloy of tungsten, iron, and manganese. *Patent completed.*

691. R. Mushet. "An improvement in the manufacture of cast steel." Dated March 18, 1859.

This consists in manufacturing cast steel by the

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addition of alloy of tungsten, iron, and manganese to melted decarbonised cast iron, the said cast iron having been decarbonised by having had air passed or forced through it whilst in the melted state. *Patent completed.*

692. A. L. THIRION. "Improvements in water, wind, steam, and hand mills." Dated March 18, 1859.

This invention is not described apart from the drawings. *Patent completed.*

693. C. LAMBERT. "Improvements in corn and seed drills." Dated March 18, 1859.

This consists in fitting a corn and seed drill on the beam of a plough behind the turnfurrow, and in obtaining motion in the seed hopper by a wheel travelling on the sole or bottom of the furrow; a set of cog-wheels which turn a shaft passing through the seed hopper is set in motion by the wheel travelling in the furrow. A sliding nut moved by a lever is attached to one of a set of cog-wheels to regulate the delivery of the grain. When not in use the drill is raised by a lever attached to a cross-piece on the handles of the plough. *Patent completed.*

694. J. W. DUNCAN and J. E. A. GWYNNE. "Improvements in, or connected with, apparatus for the generation, application, and condensation of steam, part of which apparatus or arrangements is applicable to other purposes." Dated March 18, 1859.

This invention has reference to a previous patent dated 9th Feb., 1856, and consists, 1, in arrangements for producing pure and perfect combustion of the gases, the clearance of ashes or soot, maintaining the surfaces in a good condition for utilizing the heat in producing steam and increasing the draught. 2. In insulating the steam pipe leading from the boiler to where the steam is to be used, by inclosing it inside a pipe of large diameter, which may contain felt, glass, air, or other substance, and over the second concentric pipe another of a still larger diameter is placed to convey the exhaust or waste steam between the inside of it and the outside of the second pipe; the return steam prevents radiation of the heat from the central pipe of the series which conducts the steam to the engine. The cylinders of the engine may be jacketed on the same system. *Patent completed.*

695. T. ALLEN. "Improvements in petticoats." Dated March 19, 1859.

This consists in making an air-tight petticoat of two thicknesses of suitable material, capable of being inflated by means of a mouth-piece. *Patent abandoned.*

696. W. B. GINGELL. "Improvements in the form of metal bars used for the stiles, rails, heads, and sills of window-sashes, casements, and other lights." Dated March 19, 1859.

The inventor forms longitudinal ribs, flanges, or projections on metal bars used for the stiles, rails, heads, or sills of window-sashes, casements, skylights, or other like framework or fittings. *Patent completed.*

697. E. L. BENZON. "An improvement in the casting of steel." (A communication.) Dated March 9, 1859.

This consists in heating the mould prior to pouring in the steel. For hard and soft steels different degrees of heat will be required. *Patent abandoned.*

698. S. STEIN. "Manufacturing a resinous carton or pasteboard from vegetable matter, an improvement for roofing, ship sheathing, lining walls to prevent dampness, and other uses." (A communication.) Dated March 19, 1859.

Here the vegetable substance is dried in a stove, passed two or three times through the grinding mill, and plunged into a hot solution of the resinous mixture; it remains in this solution for several minutes, is then withdrawn and hung to drip in a small close stove. After the carton has been thoroughly dripped it is placed in a vaulted stove, where it remains until the volatile oils arising from the resinous mixture have been evaporated. The carton is next removed from the stove and placed between two plates, and passed between two rollers to give it a finish. It is next exposed to the atmosphere until ready for use. *Patent abandoned.*

699. H. WHITAKER. "A new musical instrument to be called 'The Cherubine Minor.'" Dated March 19, 1859.

This consists in combining the harp, the organ, and the glass bells into one harmonious piano. *Patent abandoned.*

700. J. W. HART. "An apparatus for the destruction of flies and other insects. (A communication.) Dated March 19, 1859.

Here the inventor places in a vase vinegar, ale, or other matter which will intoxicate or suffocate the insects. On the rim of the vases he places a ring having a ledge on which is distended a piece of paper with one or more holes of about $\frac{1}{8}$th of an inch in diameter. Around the hole or holes on the under surface of the paper he paints honey to induce the flies or other insects to pass through the hole or holes into the interior of the vase, where in a short time they will become intoxicated or suffocated and fall into the liquor. *Patent completed.*

701. W. HAIGH. "An improved manufacture of paper, to be employed for the purpose of packing, and other similar uses." Dated March 19, 1859.

This consists in the addition of a layer or layers of textile fabric, or fibre, between two or more thicknesses of paper, securing such fabric or fibre in its position by paste, and passing the whole between pressure rollers. *Patent abandoned.*

702. J. HOWDEN and A. MORTON. "Improvements in apparatus for obtaining and regulating motive power." Dated March 19, 1859.

The specification of this invention sets forth many improvements in connection with steam-engines and boilers, but is too elaborate for us to quote it here at sufficient length for an intelligible abstract. *Patent completed.*

703. R. MUSHET. "An improvement or improvements in the manufacture of cast steel." Dated March 19, 1859.

The essence of this invention consists in alloying cast steel with titannum in order thereby to improve the quality of the cast-steel, such cast-steel being prepared by melting blister or other steel in the manner ordinarily practised by manufacturers of cast-steel, and alloying titannum therewith during the process of melting. *Patent completed.*

704. W. and S. PICKSTONE. "An improvement in stiffening, sizeing, filling, or weighting textile fabrics." Dated March 19, 1859.

This consists in the application of a peculiar clay or shale found in Lancashire and other coal fields, generally covering the seams of coal, in substitution of, or in combination with flour or other matters, or substances, now used for like purposes. *Patent completed.*

705. A. V. NEWTON. "Improvements in propelling vessels." (A communication.) Dated March 19, 1859.

The patentee claims the use of reciprocating pushers working in open cylinders and with the propelling surface of the said pushers acting directly against the water beyond the ends of the cylinders, also the use of a reversed set of such pushers for backing the vessel. *Patent completed.*

706. W. C. CAMBRIDGE. "An improved construction of chain harrow." Dated March 19, 1859.

The object here is to construct chain harrows so as to admit of their being readily adapted by the attendant to heavy or light work. To this end the inventor forms the chain harrows of detachable parts or sections, so that a greater or less amount of harrowing surface may be attached to the whipple tree as described. *Patent completed.*

707. W. HAGGETT. "An improved method of treating metals and other materials to increase their strength." Dated March 21, 1859.

This consists in giving to iron and other metals by rolling, pressing, or casting, an undulated surface composed of longitudinal and transverse corrugations, crossing each other at right angles, diagonally or otherwise. The same principle is also applicable to wood, papier mâché, and all other materials capable of being pressed and moulded. *Patent completed.*

708. A. BAUCQ. "Maintaining graters mechanically." Dated March 21, 1859.

The inventor proposes in the manufacture of sugar to feed or maintain the graters by placing a mechanical apparatus or moveable bottom in the feeding trough, furnished with several knives to bring together the matters to be worked in, the grater to reduce such matters to the proper size, and to distribute them in the required manner. *Patent abandoned.*

709. W. HUDSON and C. CATLOW. "Certain improvements in looms for weaving." Dated March 21, 1859.

This relates to a previous invention patented 3rd July, 1857, No. 2025, and consists, 1, in dividing the comb into several sections or short parts, which are suspended from the axis of a bar occupying the place of the stock or back rib of the comb in the original arrangement, so that the motion of each section is independent of that of the others, but each of them when pressed towards the reed beyond a certain point acts upon the bar before mentioned so as to cause it to turn upon the axis through a small angle. Any one of the sections encountering the contemplated obstruction in the sheet is thereby caused to approach the reed, pressing against and slightly oscillating the bar. The latter carries the finger which strikes the stop piece, and which finger being slightly elevated by the motion of the bar stops the loom by the same means as in the original arrangement. 2. In disconnecting the finger or arm which acts upon the weft stopping apparatus from the comb so that the motions of the latter may not necessarily disturb the position of the said finger. The disconnected comb when its dents are urged beyond a certain limit, acts upon and raises the aforesaid finger into position for acting upon the the weft fork. The comb has imparted to it a separate and distinct motion proper to itself, and is turned and regulated so as to cause the dents of the comb alternately to enter into and withdraw from the warp, inserting themselves as the slay recedes, and disengaging themselves as it advances. *Patent completed.*

710. R. WHITTAKER. "Improvements in the manufacture or construction of metallic rollers or cylinders and mandrills for printing." Dated March 21, 1859.

This relates chiefly to such rollers or cylinders as are used by calico printers for printing and ornamenting textile fabrics, and it consists in so arranging and making the rollers or cylinders as to be capable of steadily withstanding the severe lateral strain of the printing action, whilst a small quantity of copper is used in them, and they are extremely manageable and easily charged and adjusted when in use. *Patent abandoned.*

711. G. FERGUSON. "The combination and application of certain materials for the destruction of insects and vermin." Dated March 21, 1859.

The inventor uses for the purposes of the invention creosote and oil of thyne, mixed in the proportion of four parts of the former to one of the latter. *Patent abandoned.*

712. J. ROBERTS. "Improvements in packings for pistons." Dated March 21, 1859.

The patentee makes use of a ring made of any suitable metal, and keeps it fully extended to the interior surface of the cylinder by screwed studs and nuts. *Patent completed.*

713. S. LEONI. "Improvements in the manufacture of useful and ornamental articles, surfaces, and works, parts of articles and parts of machinery or apparatus, from talc and other silicates of magnesia, and from the same combined with other substances." Dated March 21, 1859.

Here, the talc, steatite, &c., is reduced to a powder, and either alone or with glass, felspar, lime, or alumina, is pressed in a plastic state into moulds, and after being removed from the moulds is baked or burnt to the requisite hardness *Patent completed.*

714. J. BICKERSON. "Improvements in opening and securing window-sashes." Dated March 21, 1859.

This relates to windows having sliding sashes, and consists in so fixing shooting or sliding bolts that a connection is secured by such bolts between the sliding edge or slide of the sash and a fixed part of the window frame. *Patent completed*

715. G. GREGG. "Improvements in currying or manufacturing leather." Dated March 21, 1859.

The patentee takes the leather in its dry state and stuffs it with or applies to it oil or tallow. To prepare the leather for skiving, shaving, or splitting, he submits it to the action of water after stuffing, and he skives, splits, shaves, or flats the leather after the stuffing, oiling, or greasing operation. To extract the bloom he applies to the grain oil, tallow, or grease, and uses a brush, stone, pumice-stone, or other suitable tools, then glosses on the flesh, dries, grains up, and waxes. *Patent completed.*

716. W. WARNE, J. A. FANSHAWE, J. A. JAQUES, and T. GALPIN. "An improved compound or preparation of materials for, and mode of covering and insulating wires or conductors used for telegraphic or electrical purposes." Dated March 21, 1859.

This compound is composed of caoutchouc or guttapercha, or the two combined, in combination with bituminous substances, to which may be added animal or vegetable oils and earthy matters, such as silicate of magnesia, rotten stone, &c. The wires to be insulated are passed through a vessel containing the compound, and through suitable dies. The insulated conductor is enclosed in a cover of woven fabric. This outer covering is payed over with some adhesive substance, on which is dusted a coating of pulverised glass or flint. *Patent abandoned.*

717. W. RHODES. "Certain improvements in fire-proof safes." Dated March 21, 1859.

This consists in adapting a supply of cold water between the inner and outer cases of safes. The water is admitted by a valve which is only acted upon by extreme heat, and this valve allows the water to flow into the aforesaid chambers or cavities prepared for its reception. In cases of fire as the water becomes heated it passes off, and cold water supplies its place. *Patent completed.*

718. G. P. A. LUTZ. "An improvement in veils." Dated March 22, 1859.

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This consists in manufacturing veils of a circular, elliptical, or any other form in which the external edge is a continuous curve. *Patent abandoned.*

719. J. DAVIS. "Improvements in musical instruments." Dated March 22, 1859.

This relates to various modes of giving a direct rotary or partly rotary motion to the piston valves of cornets and other wind instruments. It also comprises other features, but the invention is not clearly described apart from the drawings. *Patent completed.*

720. P. TAGLIACOZZO. "An improvement in metallic pens." Dated March 22, 1859.

The inventor manufactures writing and marking pens with the metal called aluminium, and with the alloys of this metal and copper, gold, silver, platinum, and any other metallic substances. *Patent abandoned.*

721. W. A. GILBEE. "An improved apparatus for stretching and polishing silk thread." (A communication.) Dated March 22, 1859.

This consists in the construction of an apparatus in which are employed a number of pegs or bobbins on which the skeins of silk to be operated upon are placed and receive a combined rotation and alternate circular or twisting motion and a regular and continuous tension. The invention is not described apart from the drawings. *Patent completed.*

722. W. WEILD. "Improvements in machinery and arrangements for coating slips, sheets, rods, and bars of metal, and laths, rods, and boards of wood, and similar articles formed of other substances, with paints, varnishes, and other like preparations, and drying the same." Dated March 22, 1859.

This consists in combining troughs, rollers, doctors, and brushes (rotating or stationary) for the purposes indicated in the title. *Patent completed.*

723. F. ASHFORD. "Improved means of fastening and securing treasure or bullion cases." Dated March 22, 1859.

This consists in passing bands of iron entirely round such cases or boxes, and bringing their ends together and uniting them by means of solder, such bands being further secured to the wood by nails. *Patent abandoned.*

724. J. T. PITMAN. "Improvements in springs for railroad cars and for other purposes." (A communication.) Dated March 22, 1859.

This invention is not described apart from the drawings. *Patent completed.*

725. E. MAYNARD. "Improving breech-loading fire-arms." Dated March 22, 1859.

This invention is not described apart from the drawings. *Patent completed.*

726. C. NEWINGTON. "Improvements in apparatus for distributing seeds and manure." Dated March 22, 1859.

To distribute seeds or manure broadcast a stopper is used having one side or part of a side hinged or moveable, so that the lower edge of the moveable side or part of a side, can be moved inwards and then back over the lower part of the hopper. The lower edge of such moveable side or part of a side is caused to move by blades or projections on a revolving axis below, and such blades in addition to giving a vibratory motion to the moveable part of the hopper, also cause the seeds or manure to descend on to a surface or platform below, to which a vibratory motion is also communicated. The seeds or manure will thus be caused to be shaken off from such surface or platform. *Patent completed.*

727. D. L. BANKS. "Improvements in suspension rail or roadways, and in machinery or apparatus connected therewith." Dated March 22, 1859.

This invention is not effectively described apart from the drawings. *Patent completed.*

728. W. P. WILKINS. "Improvements in the arrangements of valves, and in their application to steam-engines." Dated March 22, 1859.

This invention relates to circular valves which have rotary motion on their axes, and consists of various improvements in connection therewith, which we cannot here allude to it in detail. *Patent completed.*

729. Sir P. FAIRBAIRN, and R. NEWTON. "Straightening and separating the fibres of silk waste, and laying them in parallel lengths preparatory to combing or dressing." Dated March 22, 1859.

The patentees interpose between the feed apron and the opening cylinder an arrangement of screw gills with feed and delivery rollers, which being driven at regulated speeds, superior to the surface speed of the feed apron, and inferior to that of the opening cylinder, will give the silk a preparatory straightening while conducting it to the comb teeth. *Patent completed.*

730. T. MANLOVE and W. HODGKINSON. "A new method of manufacturing plain, figured, striped, and plaited textile fabrics in loom-made fabrics." Dated March 22, 1859.

This consists in manufacturing plain, figured, striped, and plaited textile fabrics by the aid of ordinary twist lace machinery, but with the addition thereto of certain mechanism, the object being to produce fabrics which resemble those now manufactured in looms. *Patent abandoned.*

ERRATA.

Abstract of specification No. 665 in our last number should have been marked as "*completed*" instead of "*abandoned.*"

Reference to a wrong specification was made in No. 37, page 174. The abstract of specification No. 289 should have run as follows:—"This invention refers, 1, to an improved method of constructing the feeding parts, whereby the length of stitch can be regulated with the greatest readiness, and the feed be given with certainty. 2. To an improved method of forming the stitch itself, whereby the loop is drawn with certainty into the path of the looper or shuttle, the improvements being alike applicable to a double or a single thread machine. 3. To the application of a needle stripper and a cloth holder combined in one instrument, and made to operate in connection with the feed-foot and needle, in such manner as to be made to rest upon the cloth with different degrees of pressure at different times, so that whilst the feeding foot is lifted off the cloth to take a new feed, and the needle is being withdrawn, the pressure shall be greatest, and shall be least at the moment of the feed being given. *Patent completed.*"

PROVISIONAL PROTECTIONS.

Dated Aug. 6, 1859.

1813. A. S. Stocker and G. J. Farmer. Certain improvements appertaining to articles to be affixed to boots and shoes, and to the feet of animals, and in machinery and means to be employed for producing the same.

Dated Aug. 9, 1859.

1842. F. L. Lawrence. Improvements in colouring and hardening elastic gums for dental purposes.

Dated Sept. 12, 1859.

2074. H. W. Ripley. Improvements in finishing dyed piece goods.

Dated Sept. 14, 1859.

2090. S. Hecht. A new mode of advertising.

Dated Sept. 17, 1859.

2122. T. Elliott. Improvements in lubricators, especially applicable to steam engines.

Dated Sept. 20, 1859.

2137. A. Manbré. The manufacture of a coloring matter for coloring spirits, beers, vinegar, and other liquids and beverages.

Dated Sept. 21, 1859.

2148. H. A. Jowett. Improvements in breaks for railway and other carriages, with means of communication between guard or conductor and driver.

2149. J. Blair. Certain improvements in the treatment of yarns during the operation of spinning, which treatment is also applicable in "roving," "slubbing," or "doubling" machines.

2152. R. Davison. Improvements in the construction of holders for containing liquid or air and other aeriform fluids, especially adapted for use in refrigerators.

2153. J. Harrison. An improvement in spinning mules, applicable also to the machines called twiners.

Dated Sept. 22, 1859.

2156. R. B. Mowbray and T. Coatman. Improvements in machinery or apparatus connected with and applicable to steam boilers and heating apparatus.

2158. E. Jones. An improvement or improvements in the manufacture of coke in open coke fires or heaps.

Dated Sept. 23, 1859.

2160. C. J. Parry. Improvements in certain apparatus applicable to sewing machines.

2162. T. Bentley. Improvements in agricultural implements for gathering and destroying weeds and stubble.

2164. R. James. Improvements in machinery or apparatus for covering crinoline, applicable also to braiding fancy patterns for other articles.

Dated Sept. 24, 1859.

2166. J. Gedge. An improved stamp holder and cutter. (A communication.)

2168. J. Coey. Improvements in or applicable to packages for containing butter, lard, and other articles.

2170. T. B. Daft. Improvements in coating metal conductors, suitable for electric telegraphs.

2172. J. Todd. Improvements applicable to screw propellers in the propulsion of vessels.

Dated Sept. 26, 1859.

2174. J. Fernihough. Improvements in pistons, plungers, and buckets.

Dated Sept. 27, 1859.

2182. R. Coales. An improved preparation or preparations for promoting the growth and otherwise improving the hair, and for the application of a certain material for like purposes.

2184. C. Cowper. Improvements in mixing or combining and deodorizing oil made from gas tar and other oils. (A communication.)

2186. J. R. Piednue. An improved apparatus for transmitting motive power. (A communication.)

2188. P. J. Lejeune-Chaumont. Improvements in fire-arms and ordnance, and in projectiles and cartridges to be used therewith.

Dated Sept. 28, 1859.

2190. W. Collins. Improvements in stand pipes for hydrants.

2192. W. J. Dorning. Certain improvements in traction engines.

2194. E. S. Cathels and S. Splatt. Improvements in gas meters.

2200. P. Robertson. Improvements in the manufacture of manure.

Dated Sept. 29, 1859.

2202. C. Stevens. An improved steam dredging boat. (A communication.)

2203. G. G. Page and C. Lungley. Improvements in gangways or step ladders, applicable to floating bodies and other useful purposes.

2205. W. Johnson. An improvement in purses.

2206. E. H. Bentall. Improvements in screw presses.

2207. C. Duplomb. Improvements in presses for pressing or finishing textile fabrics.

2208. A. W. Williamson and L. Perkins. Improvements in steam boilers.

2209. W. Kempe. Improvements in machinery for raising the pile of woollen and other cloths.

2210. R. Oxland. Improvements in the treatment of saccharine matters.

Dated Sept. 30, 1859.

2211. J. Wadsworth. Improvements in instruments or apparatus for measuring the quantity, for regulating the pressure, and for controlling the flow or passage of gas used for purposes of illumination, and in the construction of gas burners.

2212. T. Guibal. Modifying the installation and working of cables used in springing up mines.

2213. W. Hartley. Certain improvements in steam-engines.

2215. T. Buckham. Improvements in the switches for railways.

2216. J. O. Smith. Improvements in the construction of children's carriages called perambulators.

2217. B. Atkinson. Improvements in railway brakes.

2218. W. H. Buckland. Improvements in the preparation of peat.

2219. H. W. Hart. Improvements in argand and other gas burners, partly applicable to oil and other lamps.

2220. W. Clark. Improvements in railway signal apparatus. (A communication.)

2221. J. H. Johnson. Improvements in the construction of apparatus for reworking the waste steam of steam-engines. (A communication.)

2222. M. and A. Samuelson. Improvements in planing, slotting, and grooving machines.

2223. Hon. W. E. Cochrane. Improvements in chairs, and apparatus for receiving and securing the ends of the rails of railways.

2224. W. V. Edwards. Improvements in the construction of ways and apparatus to facilitate the conveyance of mails, goods, and passengers.

Dated Oct. 1, 1859.

2226. W. Parkin and J. Bates. Improvements in wedges for railway chairs.

2229. R. A. Brooman. Improvements in retre-

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beratory, puddling, and other furnaces employed in the manufacture of iron. (A communication.)

2231. J. Millar. Improvements in reflectors for diffusing artificial light.

2232. L. Newton and J. Greaves. Improvements in cop tubes or spools, and in machinery for manufacturing the same.

2233. G. Bridgett. A new mode or method of manufacturing Shetland or other falls, from the stocking frame.

2234. J. Wright. Improvements in apparatus for raising water and minerals from mines, which improvements are applicable to raising and hauling weights generally.

Dated Oct. 3, 1859.

2235. E. Morewood. Improvements in coating metals.

2237. L. H. I. Lemaire. Improvements in the manufacture of chenille.

2238. W. R. Earle and E. J. Barnes. Improvements in photographic and other portraits.

Dated Oct. 4, 1859.

2239. G. F. Greiner. Improvements in the construction of pianofortes.

2240. M. A. F. Mennons. An improved coupling joint for pipes or tubes of soft metal, caoutchouc, gutta-percha, or other yielding matter. (A communication.)

2241. M. A. F. Mennons. An improved "portejupe," or apparatus for suspending dress-skirts and other objects. (A communication.)

2242. J. Loftus. Improvements in machinery for combing and carding cotton or silk and wool.

2243. R. and W. Hollis. Improvements in the construction of apparatus for winnowing and dressing grain.

2244. S. R. English. A machine or apparatus for taking copies of writing.

2245. B. Brearley, jun. Improvements in means or apparatus for raising the nap or pile of cloths.

2246. W. Backett. Improved cleansing powders.

2247. W. E. Newton. Improved apparatus for generating steam. (A communication.)

2248. J. M. Rose, R. Carte, and W. Pikesley. Improvements in drums.

Dated Oct. 5, 1859.

2251. J. Thompson and J. Thompson, jun. The manufacture of salt by an improved and more economical mode.

2253. A. Whytock. A mode or method of applying joined sheets of metal for roofing and other purposes.

2255. J. Shields. Improvements in Jacquard looms or machinery for weaving.

2257. J. J. Eagleton. An improvement or improvements in annealing furnaces.

2259. G. Davies. Improvements in the method of, and apparatus for, vaporizing liquids and heating air. (A communication.)

2261. J. Scott. Improvements in the manufacture of anchors.

2263. W. E. Newton. Improvements in revolving fire-arms. (A communication.)

2265. W. L. Earle. Improvements in apparatus for promoting the combustion of smoke and gases arising from fuel.

2267. J. Macintosh. Improvements in the manufacture of flexible tubes.

2269. J. Macintosh. Improvements in coating metallic conductors for electric telegraphs.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Oct. 18, 1859.*)

1368. J. H. Johnson. Reducing substances to powder. (A communication.)

1383. J. Ferrabee. Forming bats of sheet sliver.

1386. K. H. Cornish. Bedsteads, sofas, &c.

1408. G. J. Farmer and G. B. Hardy. Stair rods and eyes.

1416. F. Palling. Lamps.

1417. T. F. Henley. Obtaining alcohol.

1421. G. C. Ash. Artificial teeth.

1422. B. Baugh. Raising metals.

1425. A. Smith. Purifying bees' wax.

1432. J. Dixon. Puddling steel.

1435. A. MacDonald. Punching patterns.

1441. E. T. Hughes. Lamp clock. (A communication.)

1446. N. C. Szerelmey. Preventing rust in metals.

1447. C. H. Waring. Safety lamps.

1458. H. Evette. Bedding.

1466. J. Combe and R. Smalpage. Spinning.

1479. J. Cox and S. and M. Frankham. Spurs.

1495. W. C. Fuller. Shackles and springs.

1510. A. J. Dessales. Sliding tubes.

1518. A. Chesneau. Paddle wheels.

1537. T. Leigh and J. Line. Paper.

1548. I. Tirebuck. Printing from plates.

1555. R. Kay, J. Manock, J. Whittaker, and T. Booth. Spinning, &c.

1621. W. Waite. Bonnets and hats.

1699. F. C. Bakewell. Extracting oils. (A communication.)

1756. P. Robertson. Ale and spirits.

1842. F. L. Lawrence. Gums for dental purposes.

1970. J. H. Johnson. Steam generators. (A communication.)

2022. F. C. Bakewell. Caustic alkalies. (A communication.)

2034. A. V. Newton. Flexible pipes. (A communication.)

2086. E. A. F. Lebourgeois. Surface printing.

2104. J. P. Clarke. Spools or reels.

2126. J. and C. Hawkins. Fly presses.

2157. J. Dales. Purifying sewage and water.

2201. D. Stewart. Presses.

2211. J. Wadsworth. Gas burners.

2215. T. Buckham. Switches for railways.

2221. J. H. Johnson. Steam-engines. (A communication.)

2233. G. Bridgett. Shetland falls.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS,

Sealed Oct. 13, 1859.

936. T. Bird.
938. J. Beattie.
943. A. McDougall.
945. S. Barnwell and A. Rollason.
949. G. Ashcroft.
954. J. Glasgow and S. Hand.
958. J. Hamilton.
959. A. Courage.
971. J. Whitaker.
972. J. Seaman.
977. J. Freer.
981. F. and W. Edwards.
985. P. and J. Reynolds.
992. Q. Beck.
995. A. W. Williamson.
1008. E. Clark.
1014. C. Mansel.
1019. W. Dicks and W. Hopwell.
1024. R. A. Brooman.
1031. G. Ward.
1035. J. Holmes.
1036. A. W. Gadesden
1037. E. Humphrys.
1062. Sir T. T. Grant.
1065. C. Randolph and J. Elder.
1079. E. A. Porteus and W. H. Burke.
1100. D. Moore.
1129. W. Clark.
1161. G. G. Bussey.
1183. M. Henry.
1197. W. Clark.
1222. L. D. Owen.
1251. W. C. Cambridge.
1500. G. T. Bousfield.
1654. T. Wright.
1688. J. Morgan.
1718. J. Hartley.
1765. J. Wood.
1774. W. Campbell and G. Worstenholm.
1808. R. T. Pattison.
1909. H. W. Harman.
1944. M. J. Stark.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2385. A. B. Seithen.
2394. W. and J. Todd.
2403. R. A. Brooman.
2405. T. Allen.
2419. E. Tombs.
2428. G. Wilson.
2432. G. Morton.
2434. A. V. Newton.
2460. A. Lorimier.
2497. G. Blair.
2494. L. A. Desachy.
2544. C. de Jongh.
2545. P. Fairbairn and R. Newton.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

356. J. Robinson.
858. H. H. Smith.
371. W. McFarlane.
399. J. Hopkinson., jun.
409. E. Leigh.
424. G. R. Tovell and J. Mann, jun.
432. E. Heywood.
557. R. Mallet.
761. S. Holt.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Oct. 14, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
601	0 10	611	0 3	621	0 7	631	0 5	641	0 6	658	0 3
602	0 8	612	0 10	622	0 8	632	0 8	642	0 10	661	0 8
603	0 8	613	0 5	633	0 7	633	0 3	643	0 3	663	0 3
604	0 5	614	0 3	624	0 3	634	0 3	644	0 4	665	0 3
605	0 3	615	0 3	625	0 3	635	0 10	645	0 10	682	0 3
606	0 3	616	0 3	626	0 9	636	1 4	646	0 3	6	0 4
607	0 3	617	0 7	627	0 7	637	0 5	647	0 7	694	1 7
608	0 3	618	0 7	628	0 6	638	0 7	648	0 6	710	0 3
609	0 3	619	0 3	629	1 1	639	0 8	649	0 3	...	...
610	1 9	620	0 3	630	0 7	640	1 0	652	0 3	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS IN VITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

RAILWAY WORKS, *Scotland.*—For the erection on the Lymington, Biggar, and Broughton Railway, of several station-houses and cottages, goods-shed, engine-shed, loading banks, &c. Plans and specifications and detailed schedules at office of D. Thompson, Esq., Secretary, Biggar; or Messrs. Bruce and Cunningham, engineers, 21 Castle-street, Edinburgh. Tenders to Secretary, Oct. 31.

RAILWAY STATION, *Lancashire and Yorkshire.*—For enlargement of passenger station, Rochdale. Plans, &c., Engineer's office, Hunt's Bank, Manchester. Also for the construction of stables at Oldham-road station. Particulars as above. Tenders, to Directors, and sent to Secretary, Mr. W. S. Lawn, Nov. 1.

RAILWAY CARRIAGES, *Stockton and Darlington Railway.*—For two or four first, eight second, two third class, and six composite carriages; with four vans. Plans and specifications, with pattern carriages, at the Railway Company's Coach Works, Darlington. Tenders, Railway Office, Darlington, 3rd Nov.

MINERAL WAGGONS, *North Staffordshire Railway.*—The Directors desire to hire for a period not exceeding five years, 250 low-sided mineral waggons, to carry five tons each. The tenders to Mr. S. Samunda, the Secretary, Stoke-upon-Trent, Nov. 8. A sample waggon to be provided for the inspection of the directors.

SLEEPERS, *Lymington, Biggar, and Broughton Railway.*—For the supply of several thousand larch sleepers of various sizes. Further particulars, Messrs. Bruce and Cunningham, Engineers, 21 Castle-street, Edinburgh.

RAILWAY STORES, *Midland.*—For stores for one year, from January 1st to December 31st, 1860:—1. Coals—locomotive, house, furnace, and gas; 2. Iron—tires, axles, sheets, &c.; 3. Copper, Brass and Tin—copper ingots, rods, sheets, pipes, &c.; 4. Steel, &c.—cast, shear, blister, and spring; files, saw blades, &c.; 5. Wheels—wrought-iron centres for engines, tenders, carriages, and waggons; 6. Ironwork—bolts, nuts, washers, nails, tacks, screws, &c.; 7. Iron Castings—for locomotive, carriage, and other purposes; axle boxes, &c.; 8. Ironmongery—locks, hinges, fenders, &c.; 9. Fittings—engine, syphons, cocks, union joints, &c.; 17. Timber—oak, elm, ash, mahogany, pine, deals, &c.; 18. Chair Keys for Permanent Way. Patterns at General Stores Department, Derby. 26th inst.; two forms of tender on same date from Mr. Pettifor, Derby. Tenders, addressed to General Stores Committee, Derby, by 10 a.m., Nov. 14.

BRICK SEWER AND IRON PIPE, *London.*—For construction and laying down of brick sewer and iron pipe the length of 508 feet, with other works in connection therewith, in the Park-road, Regent's Park, Middlesex. Plans, sections, and a specification, with a form of tender, may be inspected, and particulars obtained at office of Metropolitan Board of Works, 1 Greek-street, Soho, to the 27th inst., where tenders by 4 o'clock.

STREET LIGHTING, *Westminster District.*—For lighting with gas, oil, paraffine, or otherwise, the public lamps in the several streets, squares, and other public places within and under the jurisdiction of the Board of Works for Westminster district (except that portion called the hamlet), for a term of one, two, or three years, from the 25th of December next. Particulars at the offices of the Board, Great Smith-street, Westminster. Tenders, Nov. 4.

TOWN HALL, *Halifax.*—For the bricklayers' and masons', carpenters' and joiners', smiths' and founders', slaters', plasterers', and the plumbers', painters', and glaziers' works, for the erection and completion of new town-hall, Halifax, from the designs of Sir C. Barry. Drawings, &c., Council Chamber of Town-Hall. Blank bills of quantities may be obtained at the telegraph room of the Mechanics' Hall upon the payment of 10s. Tenders, Oct. 25th.

CHAPEL, *Grimsby.*—Plans, &c., in the vestry of Grove-street Wesleyan Chapel. Further information of Messrs. Bellamy and Hardy, of Lincoln, or Rev. T. Hughes, and Mr. J. Burnet, Secretaries, Grimsby. Tenders, Oct. 29.

ALMS-HOUSES, *Grindleton, near Clitheroe.*—Plans, &c., Mr. T. Barker, the Duke of York Inn, Grindleton. Further information at Messrs. Mallinson and Healey, Tyrrel-street, Bradford. Tenders, Oct. 24.

ARMY MEDICAL LECTURE THEATRE, &c., *at Fort Pitt, Chatham, Kent.*—Parties tendering must leave their name at office of War Department, Chatham, Oct. 22nd., and pay 10s. 6d. for bills of quantities.

HOUSE, *Erith, Kent.*—Drawings, &c., Mr. C. F. Maltby, 73 Coleman-street, City, E.C.

PRACTICAL MECHANICAL ENGINEER.—Accustomed to the use of the indicator, valve setting, &c. He will be required to travel occasionally, and must be capable of taking dimensions of work. Address, with references, stating age, experience, and salary required, Box 28, Post-office, Ashton-under-Lyne.

WORKING ENGINEER.—For the Essex Lunatic Asylum, Hayward's Heath. Wages 30s. a-week, with the use of the lodge, gas and water. Testimonials to Dr. Robertson, at the Asylum, Oct. 28.

FIFTY COLLIERS.—Fifty Thin Seam Colliers wanted immediately for the West Silkstone Collieries, near Barnsley. Constant employment, from 4s. 6d. to 5s. per day. Apply to Mr. R. W. Moody, on the Works.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, OCTOBER 28, 1859.

THE COST OF GOVERNMENT AND MERCHANT SHIPBUILDING.

We are often hearing much, in the House of Commons and elsewhere, about the extravagancies of the ship-building departments of our dockyards. Not very long since Mr. William Schaw Lindsay had the audacity to state in his place in Parliament that shipwrights' labour which cost £8 13s. 11d. per ton in Her Majesty's Dockyards cost but £2 12s. in private establishments, and that out of £1,000,000 voted for shipwrights' work £400,000 might be saved, and "the work would not be one whit less efficiently done." We have already shown* that these statements are monstrously false, and we might well leave them, if they stood alone, without further comment; but having before us the Report of the Committee of Economy, which formed the ostensible basis of these observations, a further consideration of the subject seems desirable.

In so far as Mr. Lindsay himself is concerned but little need be said. We believe him to be one of the worst enemies to true reform that ever held a seat in the House of Commons. Reform is safe when its enemies avow their principles, and pursue a course of honourable, if erroneous, opposition to it; but when a man springs up with the cry of reform upon his tongue, and glibly puts forth statements which have not the slightest foundation in fact, and which every man of sense and intelligence must see to be false, who shall say how much harm the cause of improvement suffers? And this is what Mr. Lindsay has been doing ever since he continued to force himself into prominence as member for Tynemouth. We all remember his flagrant speeches of 1855, made ostensibly in the interests of Administrative Reform, but which did more injury to the Association that had control of that movement than the bitterest of its opponents were able to inflict upon it. If the nature of these speeches should have been lost sight of by any of our readers the memory of them may be revived by reference to Sir Charles Wood's reply, published in the newspapers of June 23, 1855—a reply which should have silenced Mr. Lindsay for ever. But we need not go back so far to learn Mr. Lindsay's character. We have seen enough of him lately in our own columns to satisfy us. Mr. Lindsay sat, be it remembered, as a liberal member for Tynemouth, and now sits in the same capacity for Sunderland. How came it to pass, then, that he put himself under obligations to a Tory Government? That he did so we know, for his own man, Bowman, has told us so—told us that Mr. Lindsay got him put upon the Admiralty Committee. How came Mr. Lindsay to be on such good terms with a Tory Admiralty? Let every man of common sense and sagacity answer the question for himself. If he needs help in answering it he may remember that when the crisis of Lord Derby's Government came, Mr. Lindsay voted *against* the Liberal party. He nearly lost his seat by his vote; had the Sunderland electors known all, he would have quite lost it!

But, to come to the shipbuilding question, we believe public opinion is very much at fault respecting it. We honestly think, nay, we know perfectly well, that the shipwrights of our Royal dockyards work quite as hard and as well for every shilling they earn as shipwrights in private dockyards. We have been familiarly observant with both systems. We have closely watched shipbuilding operations in the private service oftentimes; we know our public dockyards well; we have conversed scores of times with officers who have supervised work in both; and we unhesitatingly say that the Government shipwrights are in no way inferior, either in skill or diligence, to others. This is saying the very least that is due to them. And, of course, the whole question of economy, in so far as the cost of work is concerned, is involved in this consideration. We say nothing here of collateral matters, nor can we receive, in contradiction to our statements, any evidence as to what dockyard accounts show. These do not affect the actual cost of "shipwrights' work." Our point here is, that the shipwrights of Her Majesty's dockyards earn their money as honourably and as unquestionably as any shipwrights in the kingdom; and we challenge Mr. Lindsay to prove, or even to give a colourable reason for saying, that they do not. Bad officers sometimes exert bad influences upon the men, and none are more likely to do this than over-active captain or admiral superintendents. When these naval gentlemen are given to meddling with what they do not and cannot understand, mulcting every man whom they happen to detect doing nothing, whether he be an industrious man or not—in other words, when dockyard superintendents convert themselves into a malignant sort of policemen, as they sometimes do—then mischief ensues. We remember many instances of this kind; we may mention one. A certain captain superintendent discovered two shipwrights who appeared to be chatting at the ship's side, and, although the men were really talking over a difficult piece of work which they had to do, and which required consideration, they were mulcted of a day's pay: the same officer at about the same time detecting a workman filing down a piece of *lignum vitæ* wood at a bench, was well satisfied to learn, at his own suggestion, that the man was "sharpening his mallet," although the fellow was in truth preparing material for a medicinal infusion! If this officer had been either just or wise, he would neither have fined two men undeservedly nor have made himself the laughing-stock of a third. As it was, he, like many others, injured the service by making every man feel that he must keep a careful eye upon him, which could only be done at the expense of the work itself. We might mention other causes which occasionally operate against the diligence of the Government workmen; but as these are exceptions to the rule, we need not dwell upon them.

It is not a little astonishing that such men as Mr. Murray and his colleagues should have ventured to pronounce judgments upon the shipbuilding operations of our dockyards. Mr. Murray would be the last man in the world to consider shipwright officers justified in discussing the details of his department, and a very small amount of modesty would have sufficed to warn him against entering, as he has done, upon a criticism of their business. Yet it was he and Mr. Bowman who originated the monstrous statements before quoted, which Mr. Lindsay reproduced with so much unction. We must quote the paragraph (967) in which they finally deliver themselves of their conclusion upon this question:—

"Eight of the corvettes before referred to, "cost, for shipwrights' labour, without fitting "for sea, 109s. 8½d. per ton, and one fitted for "sea cost 173s. 11d.; while it was stated in "evidence to the Committee, that a corvette, "if built in a private yard, with scantlings, "fastenings, and workmanship similar to ships "in Her Majesty's navy, fitted for sea, would "be about 52s. only per ton for shipwrights' "labour. Allowing for any superiority in "workmanship in the dockyard, or other difficulties, [*sic.*] the Committee can see no reason "why ships should not be built for a price in "the dockyard at least approaching to that "paid in private trade, if the same system of "working the men, as now recommended, be "adopted, instead of their costing, as in the "case above quoted, more than three times as "much."

Can it be possible that this Committee was so utterly ignorant of what they wrote about as to believe that ships of war can be built and equipped for sea for 52s. per ton? Or, if they were so, can Mr. W. S. Lindsay, the great shipowner, the man who puts himself up as an authority on such questions—can he have known no better? It is only charitable to believe he did. Let us hear, however, what Mr. Pitcher, the shipbuilder of Northfleet, says upon the subject. When the remarks of the Committee began to find their way into the public press, he addressed to the Surveyor of the Navy the following letter:—

"Northfleet Dockyard, 11th July, 1859.

"Sir,—I cannot permit the statements which "I have read in the *Times* of Saturday to pass "unnoticed. It is there asserted that the labour "for building a vessel of war in the merchant "yards does not exceed the sum of £2 8s. per "ton for shipwrights' labour; but it should be "understood that the ships alluded to were "*mere shells* when sent to Her Majesty's yard "at Chatham, to be fitted as might be required, "as the cost of such fittings would depend very "much upon the service they were intended "for. I am of opinion that the vessels built "for the Government in private yards, when "compared with those built in the Royal Dockyards, according to the evidence published, "amounts to *very near the same sum* for the "total completion in the hull; for instance, in "the labour for building about 13,500 tons of "the gun-vessels at Northfleet, they cost, on an "average, complete, about £6 per ton.

"Trusting that you will not consider me "intrusive in offering these my observations, "pray believe me, &c.,

(Signed) "Henry S. Pitcher."

To this letter the Surveyor of the Navy appends the fact that from the examination of accounts recently made, it is found that the cost for shipwright labour in building and fitting for sea the corvette alluded to by the Committee (the Pearl) is not £8 13s. 11d. per ton, but £7 2s. Mr. Chatfield, in his counter report, throws much further light on this question. He tells us that returns as to the state of the two vessels alluded to by the Committee and Mr. Pitcher—the Cossack and Tartar—have been obtained from Chatham Dockyard, where these ships were completed in 1854-5, and the returns show that on the Cossack the sum of £3,597 was expended in completing the hull, £2,087 on materials, and £1,510 on workmanship, and nearly equal sums upon the Tartar. He further tells us that when the Cossack was repaired for a second commission in 1858 no less than £5,771 had to be expended upon her; many of her planks were found to have been broken in the working. As Mr. Chatfield remarks,—"the fact of the Cossack "requiring £9,368 to be expended upon her "within a period of four years, was certainly "not a very remarkable instance of the economy "of private shipbuilding beyond that of public "departments."

It may be well, perhaps, before quitting this subject, to show that we are not alone in our estimate of the Government shipwrights and their work. Mr. William Brown, who spent several years in the private service, having

* See Mechanics' Magazine for July 22.

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been a working shipwright at Messrs. Wigram and Greene's, and a foreman of Mr. Graham's at Harwich, in evidence before the Committee, said, "In the Government service the work is "materially better; it is three times as well "done, and worth three times as much money." He also said, "I think there is a better feeling "among the dockyard men to get through a "day's work (even on day-pay) than there is "among the river men when they are working "for a private master." Mr. William Baines, the present Timber Inspector of Deptford Dockyard, a very experienced officer, said, "I "have seen all sorts of work and workmen, and "I am fearless to assert, and capable at any "time to prove, to any shipwright, that there is "more, better, and harder work performed by "the shipwrights in Her Majesty's Dockyards "for the money paid than in any other part of "the world, and the workmen, taken as a body, "much superior to any private establishment I "ever saw." We could readily multiply such testimony.

MR. FAIRBAIRN'S STEAM EXPERIMENTS.

Mr. William Fairbairn, aided by his mathematical friend Mr. Thomas Tate, has once more been performing experiments which scientific men will gladly welcome. On another page of this number we print the results of some recent inquiries of theirs into the law which connects the varying densities and temperatures of steam.

It has long been suspected—or rather, it has long been placed beyond suspicion—that the law put forward by Dalton and Gay-Lussac, however sound as applied to ordinary gaseous bodies, is not correctly applicable to steam, or, indeed, to any condensable vapours whatever, although it has formed the basis of all our standard writings on the subject. Dr. Joule and Professor W. Thomson were first led, some time since, to notice the failure of the law in this respect, owing to discrepancies which they discovered in applying what is called the Dynamical Theory of Heat to Carnot's law, and later Professor Rankine has gone so far as to put forth a new formula favouring the view of Joule and Thomson, and opposing that of Dalton and Gay-Lussac. With the question in this condition Mr. Fairbairn has turned his attention to it, and very properly decided upon appealing to experiment for evidence of the truth of the matter.

The details of the experiments undertaken by Mr. Fairbairn and Mr. Tate are set forth with sufficient fulness in the paper above referred to. The results deserve especial mention. Expressing the density of the steam by means of numbers representing how many times the water composing it has been expanded, they obtain some very remarkable departures from the results given by the old formula. For example, where the latter gave 1005 for a temperature of 244°, the experiment gives 896 only; for a temperature of 245°, the formula gave 969, the experiment 890; for 257°, the numbers were 790 and 651; for 262°, 740 and 680; for 268°, 680 and 633; for 270°, 660 and 604; and for 283°, 540 and 490. These determinations at pressures varying from ten to fifty lbs. above the atmosphere are, as Mr. Fairbairn says, not accurate reductions from the experimental results, but only approximations. They uniformly show, however, a decided deviation from the law for perfect gases, and in the direction anticipated by Professor Thomson, the density being uniformly greater than that indicated by the formula. Mr. Fairbairn hopes by the time of the next meeting of the British Association, with the assistance of his friend Mr. Tate, to be enabled to lay before the section a series of results which will fully determine the value of superheated steam, and its density and volume as compared with pressure at all pressures varying from that of the atmosphere to 500 lbs. on the square inch. The facts which he thus hopes to ascertain are very much needed, and we heartily tender him our thanks, on behalf of the scientific public, for his labours in the matter. The fact of many of our first engineers taking patents for every conceivable form of superheating apparatus is a very significant sign, and there are no doubt great advances to be made in that direction.

MR. RUSKIN ON THE WORKMAN AND HIS WORK.

Mr. Ruskin is a gentleman of very high culture, tastes, manners, thoughts, and pursuits, and as such deserves honour of individuals and of society. He is possessed of extraordinary energy, vivacity, keenness of sight and of analytic power, and lives a life of wonderful activity, as a thinker and writer, traveller and artist.

There are two kinds of writers in the world. One man writes as possessed by a power behind and beyond his own volition and reflection, producing and creating through him: the writers of this type are the warm, rich, genial nourishers and enrichers of the world. Another type of man is he who deals with the material that genius has produced, labours at it, manipulates it, analyses it, reflects on it, distinguishes and classifies its separate parts, interprets and applies it. Mr. Ruskin is eminently a writer of the latter kind. In all his writing he always impresses you as working hard, as conscious, reflective, and of narrowly-defined aim. The world has need of both types of man, and thankfully accepts them both with all their differences.

Goethe says that in our fourteenth year we generally paint black and white very close to each other, and fail to see the innumerable subtle gradations by which each melts into the other in nature and in life. Goethe might have said the *fortieth* year of too many of us. Mr. Ruskin's great failing is just this: he makes most exaggerated, one-sided distinctions and classifications: for example, when he says that the Greeks made the living human form their sole study, and proudly disdained nature in her lower and humbler shapes, we call to mind that the horse, ox, and ram are as exquisite as the human figures in the Greek sculpture, and that Homer had the quaintest fondness for nature's plainest and humblest forms. Mr. Ruskin has committed himself to the most narrow and dogmatic assertions in some of the highest branches of human inquiry. He often writes in a most dictatorial and schoolmasterish tone. Often he seems to us a ceaseless talker, and not at all because of that redundance of words, which, like Shakespeare's or Goethe's, is the welling up and overflowing of an opulent, inspired soul. For all that, we confess we always read every fresh work of his, and always find him so vigorous, clear, varied, honest, and earnest, that we heartily thank him each time for his book.

The post Mr. Ruskin pre-eminently occupies as a writer, and which mainly concerns us in the pages of this journal, is that of communicator and interpreter between English thinkers and workers. His effort is to infuse our thinkers' thoughts into our workers and their work. What he teaches is not something new he has discovered, or anything new in itself, properly speaking. Our best things are our oldest. The sun-rise, the mother's love, the beauty and poetry of childhood, are not newest, though they are of our best. The oldest facts, as experiences, visions, convictions in new and living men, are what we want. Mr. Ruskin's main idea is a very old one; it is this: that the work of man's hand reveals the worker; that whatever man works at, his supreme aim should be to pour as much of himself, as much of his intellect, taste, enthusiasm, affection, imagination into the work as the work is capable of receiving; that that is the highest work of man in which he can embody the greatest number, fulness, and intensity of human elements; and that he is the highest worker who can impress most clearly and completely the image of man upon his work. We cannot attempt to follow Mr. Ruskin in his endless applications of this principle, but must content ourselves with two or three examples. In his last volume, "The Two Paths,"* he tells the people of Bradford, that those who design the patterns for pottery, carpets, wall-papers, curtains, and apparel, should be reared and live amidst beautiful natural forms, and strive to repeat these. He complains, in this volume, that architecture is made a mere science of mathematical proportions in our day. The disposition of lines and masses in agreeable proportions—as in any work of Sir Christopher Wren's—he grants to be a task for genius alone, but only for a fractional part of human genius. He contends that in old Gothic architecture the walls and buttresses, the pointed arches, and steep gabled roof were but the mere outline and framework of those grand old edifices; and that the real work of those old builders was to cover and fill up that framework with endless reproductions of organic shapes from the floral, animal, and human worlds. So that all our talk about a new style of architecture is purely idle; and it matters little what outline and framework the architect adopts, but a great deal that he should be a student of God's creation, and should glorify his edifice with records of the visions and raptures God's world has afforded him. From the same point of view Mr. Ruskin pities the man who has no room in his work for the expression of himself. We quote from his "Stones of Venice":—

"We have much studied and much perfected, of late, the great civilised invention of the division of labour; only we give it a false name. It is not, truly speaking, the labour that is divided, but the men: divided into mere segments of men—broken into small fragments and crumbs of life; so that all the little piece of intelligence that is left in a man is not enough to make a pin, or a nail, but exhausts itself in making the point of a pin, or the head of a nail. Now it is a good and desirable thing, truly, to make many pins in a day; but if we could only see with what crystal sand their points were polished—sand of human soul, much to be magnified before it can be discerned for what it is,—we should think there might be some loss in it also. And the great cry that rises from all our manufacturing cities, louder than their furnace blast, is all in very deed for this—that we manufacture everything there except men; we blanch cotton, and strengthen steel, and refine sugar, and shape pottery; but to brighten, to strengthen, to refine, or to form a single living spirit, never enters into our estimate of advantages."

What a voice there is for our "industrial "age" in the great principle we have been hinting at. What will deliver us from sham-work and half-work in our manufactures? What will lift our industries above the petty squabbles about price of labour? Awaken in men this old law, implanted in us all by our Maker, that whatever a man does he should do it with his whole heart, his whole self. Teach a man that his work is an emblem of himself; that a piece of work slovenly, stupidly, uglily, half done, shows a sloven, stupid, ugly,

* The Two Paths; being Lectures on Art, and its application to Decoration and Manufacture, delivered in 1858-9. By John Ruskin, M.A. London: Smith, Elder, and Co., 65 Cornhill.

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half man; that such a piece of work is a gross immorality in the sight of nature and mankind; that it re-acts on the worker, and confirms him in the bad elements he has imprinted on his image; that if all men worked as he works, we should in one year reach general bankruptcy and rottenness. But teach him that if he brings attention, conscience, taste, enthusiasm to that work, that such work is a living, breathing embodiment of morality and religion; that whenever he looks at it, it will give him faith in himself, and encouragement and hope for himself; that wherever it goes it will give assurance of the existence of so much human worth and beauty, making men believe in human worth and disbelieve in human baseness.

If we had space we would fain quote at large from Mr. Ruskin's noble pages about labour. Take the following from his "Stones of Venice," on the honourableness of manual labour:—

"We are always, in these days, endeavouring "to separate intellect from manual labour; we "want one man to be always thinking, and "another to be always working, and we call "one a gentleman and the other an operative; whereas the workman ought often to be "thinking, and the thinker often to be working, "and both should be gentlemen in the best "sense. As it is, we make both ungentle, the "one envying, the other despising his brother; "and the mass of society is made up of morbid "thinkers and miserable workers. Now, it is "only by labour that thought can be made "healthy, and only by thought that labour can "be made happy, and the two cannot be separated with impunity. It would be well if all "of us were good handicraftsmen in some kind, "and the dishonour of manual labour done "away with altogether."

Let the following extract from the close of the first lecture in "The Two Paths," conclude our hasty remarks:—

"All of you have the trial of yourselves in your own power. Each may undergo at this instant, before his own judgment-seat, the ordeal by fire. Ask yourselves what is the leading motive which actuates you while you are at work. I do not ask you what your leading motive is for working—that is a different thing; you may have families to support—parents to help—brides to win; you may have all these, or other such sacred and pre-eminent motives to press the morning's labour and prompt the twilight thought. But when you are fairly *at* the work, what is the motive then which tells upon every touch of it? If it is the love of that which your work represents—if, being a landscape painter, it is love of hills and trees that moves you—if, being a figure painter, it is love of human beauty and human soul that moves you—if, being a flower or animal painter, it is love, and wonder, and delight in petal and in limb that move you, then the Spirit is upon you, and the earth is yours, and the fulness thereof. But if, on the other hand, it is petty self-complacency in your own skill, trust in precepts and laws, hope for academical or popular approbation, or avarice of wealth—it is quite possible that by steady industry, or even by fortunate chance, you may win the applause, the position, the fortune, that you desire; but one touch of true art you will never lay on canvas, or on stone, as long as you live.

THE LIBRARY COMPANY.

A company under this title has been started at 22 Paternoster-row, for the purpose of supplying libraries of standard works to all classes. It is not our object here to make that portion of the design which has any other interest than that of the working man, or the middle classes, more popular, although the wealthy, we fear, in too many cases, need a little gentle stimulus to do more than to provide themselves with a good library—to read it. The address, which is before us, states that there never was a time when the activity of the press was so great as at present, and when the number of readers was so large, and so continually on the increase. But when we inquire what the people read—whether old books or new, good books or bad—the answer is not so satisfactory to the moralist and the well-wisher of his kind as the mere statistics of the activity of the printing press might seem to warrant. There is a large class of people—they may be numbered by hundreds of thousands—who read little but religious tracts adapted to the intellectual capacity of children. There is another class, quite as large, who read little or nothing but the cheap periodical publications, containing the police-reports, and the records of murders and prize-fights. There is another class, perhaps quite as large as either, who read prurient or silly novels and stories, provided by cheap weekly periodicals, and to whom the best works of the greatest English authors are scarcely known, even by name. Those who look into the cottages or houses of the working man, and even of the clerk or the tradesman, seldom find any books but an old almanack or magazine, and still seldomer a library, however small. Sometimes a few odd volumes are used as a base for the tea-caddy or the work-box; but beyond these nothing is to be found worthy of the name of literature. In the villa of the merchant, the drawing-room table, and a small ornamental book-case, often contain the elegantly-bound, but too often useless or exhausted literature of the family. In the houses of the professional and upper classes only are to be found books in such quantities as to deserve the name of a library.

To help the public to supply this deficiency, to aid the working man in selecting for himself something better than obsolete, silly, or pernicious novels, that pander to the lowest tastes and instincts; to give to the clerk and the tradesman a literature of substantial books, and to impress upon the merchant and the owner of the villa that a good library ought to be as essential to their position and their comfort as a good wine cellar, and that good books are even more necessary than good paintings; to enable large houses of business to establish suitable libraries for their clerks and young men, at a moderate cost; and generally to aid all classes of the community in the task of selecting such libraries as may be within the compass of their means, is announced as the object of the promoters of the Library Company.

"They are of opinion that the name of Dr. "Charles Mackay offers a sufficient guarantee "that the books will be well chosen from the "masterpieces of English literature, and that, "whether instructive or merely amusing, their "elevation of tone and purity of character will "be such as have received the sanction of "public opinion and the award of the highest "criticism. It will be made a principle of the "company's operations that no books of sectarian or controversial theology shall be included in the list; but if a purchaser desire "to make any alteration in this respect, he will "be allowed to substitute such or any other "books of the same price. Particular attention is called to the fact that the libraries are "exchangeable at half the price charged, "within twelve months of the purchase, if in "good condition."

These libraries, it would appear, will be supplied at from £1 to £1,000. For instance, the Working Man's Library for £1 contains twenty-six volumes bound in thirteen, and includes the histories of England, Scotland, Ireland, and France; a Biographical Dictionary, Travels, and Voyages of Discoveries in Europe, Asia, Africa, and America, and other useful works indispensable to the working man. For an extra £1, Astronomy, Geology, Fiction, Poetry, and miscellaneous works by well-known authors. For another £1 the selection rises still higher, and so on. The Cottage Library is likewise happily selected. The Boys' and Girls' Library, the Family Library, the School-room Library, the Institute or Family Library, the Fifty-Pound Library, &c., &c., follow in like order, and are equally well arranged for the several classes for whom they are designed.

The movement is a wholesome one, and highly characteristic of the period. We wish it every success, and are right heartily glad to hear that it is already receiving support from those practical and philanthropic minds which are ever the first to seize upon a useful object, and carry it effectively to the most beneficial consummation.

THE SOVEREIGN AND THE SHILLING.

Although the above-named coins are exceedingly popular, and are ever moving from hand to hand, and from pocket to pocket, yet how few persons know exactly their dimensions, weight, or the precise composition of the metals of which they are made! With the impressions upon them we are all happily familiar; but it is right, too, that their other characteristics should be known. As the more aristocratic coin of the two, statistics of the sovereign may be first given. The sovereign contains, when passing in the bloom of youth from the Mint, 113·001 grains of *fine* gold, but the addition of alloy-copper makes it weigh actually 123·274 grains of *standard* gold, or decimally 0·2568 oz. Its diameter is 0·863 in. The lb. troy of standard gold—which at the Bank of England is invariably £3 17s. 10½d. per oz.—is therefore coined into £46 14s. 6d. current money, or 46⅔ sovereigns. A million of these very interesting coins would weigh 10 tons 14 cwt. 0 qrs. 14 lbs. 2 oz., and if they were placed on the ground in single file and touching each other they would form a golden track fourteen miles in length. At the Mint it would take a week to spin such a thread.

Let us turn now to the more plebeian shilling. The new shilling contains 87⅙ grains of standard silver, and standard silver consists of a mixture of fine silver and copper, in the proportions of 11 oz. 2 dwts. of the former to 18 dwts. of the latter. Its diameter is 0·915 in. The lb. Troy is coined into sixty-six shillings. The value of a ton weight of shillings (current) is £6,600, and the cost of a ton of standard silver in the market averages £6,000. A million pounds worth of shillings (£1,000,000) will thus be found to weigh 151 tons 10 cwt. 1 qr. 5 lbs. 3 oz. 12 dwts. 17·4 grs., whilst the number of pieces would, of course, be 20,000,000. It is supposed that there are in existence at this hour 50,000,000 of sovereigns and about 120,000,000 of shillings! enough, one would think, for the wants of Her Majesty's lieges, scattered though they be over the two hemispheres. But these quantities are ever being added to, and other countries are always supplementing them with their own peculiar coins. The demand for money evidently keeps pace with the march of civilisation, and the nude savage of to-day will have perhaps a shilling, or it may be a sovereign, in his *pocket* to-morrow.

Mr. Donald M'Kay, the eminent ship-builder of Boston, U.S., has arrived in England from America, bringing with him plans and specifications of several vessels of war, guns, &c., for the use of some of the European naval powers. Mr. M'Kay has obtained permission from her Majesty's Government to visit the various dockyards of this country, and after having accomplished this, he will proceed to the Continent, visiting the dockyards of France, Austria, Russia, and the other naval Powers of Europe.

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THE GREAT EASTERN'S TRIAL TRIP. *

BY A PASSENGER.

At nine o'clock on the evening of October the 7th the Burdon Hotel, Weymouth, had already begun to overflow with visitors. Each newly-arriving adventurer, no matter what his rank, was inexorably consigned for the night to the care of lodging-house keepers, scores of whom seemed willing enough to eke out the accommodation of the Burdon. The moon hung so fair above the bay, and the waters murmured so musically upon the shore, on the very verge of which the hotel and its neighbouring terraces stand, that I was pleased with an occasion for escaping from the bustle and excitement of the establishment, and with the opportunity thus afforded of enjoying the moon-lit air and sea, and therefore gladly accepted an appointment to supplementary apartments.

After ascertaining from friends who had been on the spot for days that the contractors were fully prepared for the next day's departure, and that nothing but an adverse determination on the part of the directors of the company would interfere with the anticipated voyage—although the friends of Mr. Scott Russell were unanimous in urging him to seek rest from his arduous labours for a day or two before undertaking the responsibilities of the journey—I had the good fortune to meet a gentleman who had been familiar with the great ship from the first, and who up to the very evening of our conversation had performed important duties on board of her. From him I received much minute information respecting the condition in which she then was, and was pleased to find that even his critical eye had found nothing of serious importance to rest upon. During the time that had elapsed since the ship's arrival at Portland her water-tight bulkheads had been brought into a better state of integrity; an excellent suit of sails had been bent on yards and gaffs; a crew that satisfied the captain had been finally organized; the wheel-ropes had been replaced by chains, so arranged as to increase the control of the steersmen; the engines had been placed under the absolute control of the gentlemen who built them; and altogether the Great Eastern had been brought for the first time into a "ship-shape" condition. My own observations subsequently confirmed the report of my experienced friend in all important particulars, and convinced me that, although a hyper-critical person might find much to complain of, a real and earnest effort had been made to satisfy the just requirements of the press and the public.

On Saturday morning the company who were to witness the trial trip steamed from the quay at Weymouth to Portland harbour, and embarked on the largest vessel—indeed, the largest moving body of any kind—that the hands of men ever made. So much exclusiveness was displayed by the proprietors of the ship on this occasion, that the only individuals who were likely to publish scientific criticisms upon the vessel or her machinery had to get entrance afforded them by the device of an influential friend. For my own part I went on board nominally in some very responsible capacity, the nature of which I never in the least understood, and the duties of which gave me not a moment's trouble. Even the "gentlemen of the press" scarcely succeeded in securing a timely invitation, I was told. It was agreeable to observe, however, that some experienced and excellent officers of the Royal Navy had contrived to make their way on board, and would be ready to afford their aid should the necessity for it occur. Perhaps I should not exaggerate the truth if I were to say that some of the passengers also derived satisfaction from learning that we had with us a valuable life in the person of a Member of Parliament whose income is said to be about £150,000 a year, the ground of their satisfaction probably being a vague hope that even steam and storm might hold in respect that which man so profoundly reverences.

Without the least desire to be ungracious, even in thought, I could not avoid remarking the absence of many who had shared the first trip with us, and conjecturing the cause which kept them away. How many among them had the explosion scared? I think the changes observable in the representatives of the newspapers forced this question upon me more than any other. Why was it that the journal which appeared in the form of a tall personage on the one occasion manifested itself in a short form on the other? Why did the paper that spoke Hibernian speech before speak Anglican now? How came it to pass that the organ which wore a brown shooting jacket and a sky-blue cap from the Nore to Portland appeared in a dress coat and a high hat from Portland to Holyhead? Far be it from me to believe that craven apprehensions wrought these changes. I put the questions in the full confidence that every reader will imagine for them perfectly satisfactory answers.

Between three and four in the afternoon of Saturday the anchor was weighed, and notwithstanding some small details which might be altered with advantage to this operation, the manner in which it was effected, and the perfect control which Captain Harrison exerted upon the vessel as soon as it was completed, deserved and gained the warmest approbation. Unhappily, before the breakwater was passed the dinner bugle summoned the guests below, with a sound which few Englishmen know how to disobey, and which, in truth, was not disobeyed by many on this occasion. The departure from Portland consequently lost much of its beauty in so far as those on board the ship were concerned. To those on shore the sight was doubtless very impressive.

And truly the first movements of the Great Eastern should be full of interest for us. We have in her a mighty assemblage of machines to deal with, and to put which on its trial is no light matter. In her hull we have 8,000 tons of iron shaped into a ship, and formed to sit in the water steadily, to roll in it easily, to resist it sturdily, to divide it cunningly. In her depths we have 112 furnaces flaming, devouring more than ten tons of coal every hour, and keeping more than 400 tons of water hissing into steam. Hung at her sides we have vast wheels weighing nearly 200 tons, and turned by an engine within her with the strength of 3,000 horses. At her stern we have revolving a ponderous screw propeller on which a still greater power has to be exerted. And behind all these hangs a plate of metal by which the movements of this leviathan are to be controlled, and which has itself to be obedient to the hands of a man or two. The proportions of all these limbs or organs of the great ship are so unexampled, and the arrangements and combinations of some of them are of so novel a character, that when we see the whole of them together put upon trial we may well watch their operation with eager interest.

At forty minutes past five we passed the Bill of Portland, and stood fairly down Channel under the most favourable circumstances. During the evening a loud screaming, not unlike that of a living being, was heard to proceed from the middle of the ship, renewing itself with every revolution of the paddle-engine. This disturbance, which caused some sensation at first, was found to proceed from one of the cylinders in which a valve had got opened, the escaping steam screaming its way out into the engine-room. A little manipulation on the part of the engineers in attendance cleared the valve, and put an end to all the noise and excitement, without even so much as bringing the engine to rest. A like occurrence happened later on the voyage in the screw engine department, and was remedied with the same ease and expedition. On another occasion, the screw engines astonished some of the company by performing an air after the manner of a mellow set of bagpipes. This arose, as we soon learnt, from a loose fragment of india-rubber packing, which a current of steam set vibrating with great rapidity, and which made music on the same principle as common reed instruments.

As night drew on, the Eddystone became visible, and having seen it on our beam about half-past eleven, my admiration of the midnight moon and sea began to flag, and I allowed "seven bells" to ring me to my berth. When I went below the weather was moderate, and on the whole fine, and even to nautical eyes no omens of change had, I believe, shown themselves. It was with some little astonishment, therefore, that after having slept but for two or three hours, I awoke to hear a high wind blowing, and to see through the dim circular glass of my cabin window, that the heavens were filled with cloud and mist, and the seas blown into a tumult of wave and foam. Thinking that a turn upon deck at such a time might prove interesting, and trusting that a careful regard to costume might be dispensed with at two o'clock in the morning in the solitude of the Channel, I speedily made my way upward, and ascended the foremost of the two bridges which extend from paddle-box to paddle-box. The Lizard lights were gleaming wildly away on our starboard bow, and not a sound was to be heard but the roaring of the wind in our rigging, the beat of the paddles on the sea, and the muffled thumping of our screw engines. Captain Harrison and one or two of his officers stood by the telegraphs that signal to the engines and helm, and on the bridge on which I stood a "look-out" or watchman paced. There was light enough to reveal this man very clearly to me, and from the moment at which I first saw him, I was struck with his absorbed and absent manner. After observing him for some time, and wondering what his thoughts were, I stepped to him and asked with affected ignorance what lights they were which we were passing. His answer being, "The Start," and I knowing they were the Lizard, and that the Start had been passed several hours earlier, nothing further was needed to convince me of the ability of this mysterious mariner. But something further, nevertheless, occurred. For presently a light began to sparkle nearly ahead of us, slightly on our port (or left) side, and from the bow a strong voice shouted—"Light on the port bow." "Light on the *starboard* bow," straightway cried my absorbed friend to the captain, who instantly began to peer over the starboard bow for the light. Seeing the danger of this proceeding I whispered "PORT bow," in the hearing of my friend, who proudly echoed "Port bow,"—but too feebly for the captain to hear it. Meantime, we were coming rapidly up to the light, and a schooner which carried it began to show herself much more quickly than I expected. Fortunately, Captain Harrison saw her on the instant of her becoming visible, and with a lusty, "Port the helm,—hard aport," which Mr. Lungley's admirable apparatus transmitted to the stern instantaneously, contrived to turn the monster from her puny prey, and allowed the schooner to pass in safety just clear of our paddle-box. Had the Great Eastern not answered her helm admirably that night, one vessel less would have sailed the seas now, and probably half a dozen men more would have been "full fifty fathoms down," and that absent watchman alone would have been answerable for them. Why, I wonder, did that man call the Lizard the Start and port, starboard? Was it that grog had befooled his reason? Or, may he not have been a spasmodic poet inditing sonnets to the "swirling moon"? Revolving these questions I went below, and sought sleep again, with all the confidence which the circumstances of the time inspired.

Morning rose freshly and finely as morning ever rose, revealing far away to the north the sparkling Isles of Scilly. To the long swell of the seas which rolled *across* her path the Great Eastern yielded majestically and with a kind of motion which it may be well to mention here more particularly. On board a vessel rolling and pitching in a seaway we are made sensible of two kinds of motion—a rising and falling, and a turning partially over. The amount of the latter motion depends upon the angles through which the ship

* We could not find space for the above article (which has been in type nearly a fortnight) in our last number.

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rolles or pitches, or, in other words, upon the inclinations given to her deck by the action of the sea. As the dimensions of ships are increased the effect notably is to reduce these angles or inclinations, for reasons which need no mention here. This fact was particularly observable on the morning under notice. The extremities and sides of the great ship rose and fell through considerable spaces, but the inclination of her decks was always very slight indeed. Near amidships, or the middle portion of her—in her dining saloons, for example—the motion was almost imperceptible, while the paddle-boxes at her sides, and her bow and stern likewise, moved up and down through many feet. Those who take passage in the Great Eastern hereafter may find in this fact a hint that may prove useful to them in the selection of berths.

To counteract the rolling motion which the crossing seas occasioned sail was for the first time set upon the ship. The wind came with sufficient directness upon the ship's side to render this practicable, and to keep the fore and aft sails full when set. That the sails had any other considerable effect than that of steadying her I do not for a moment believe, and I fear those who have publicly attributed to them a knot or two of the speed then made, possess very imperfect notions of the force of wind which would be requisite to add those amounts to the speed of a ship already moving at the enormous velocity of from 14 to 15 knots (16¼ to 18 miles, say) per hour. Even experienced ship captains may be mistaken on this subject. The sails doubtless helped the speed to some extent by keeping the vessel steady, and thus enabling the paddles to do their work efficiently, but certainly not much in any other way. The speed attained that morning was, according to the newspaper correspondents, 14¼ knots—according to the officer who cast the log, 15 knots, as I affirm from the evidence of my own senses. This was the highest velocity attained throughout the trial trip, but there is no reason why the same should not be again reached under favourable circumstances.

While the sails were being set we had a sermon preached on board, of which I had either the good or the bad fortune to hear only when it was in progress. The subject of it is said to have been the catastrophe off Hastings, and the moral of it the necessity of living in perpetual preparation for sudden death. Possibly as effective a discourse was read to us who kept the deck, and who saw beneath us the grandest product of that science which the Prince Consort extolled so nobly at Aberdeen, while around us spread the shining floor, and above us the azure dome of that "Cathedral of Immensity" in which the anthem of good men's adoration rises eternally.

Throughout the day we kept an unswerving course for the Old Head of Kinsale. When at length towards evening Ireland lifted itself blue and bright before us, it was resolved (as we passengers understood) to run and show ourselves at Cork harbour, and thus afford an opportunity for the telegraph to send to London news of the successful completion of the first half of our trip. With this view, as the sun set we took in sail, and steamed directly towards what those of us who knew not the coast believed, on very high authority, to be that harbour. Presently a nautical man of great repute, who knew the coast well, and had probably taken fleets into Queenstown harbour many times, privately advised me that we were making fair, not for it, but for Kinsale harbour! We went together to the chart, and he marked our position upon it. On reascending the deck he pointed to a headland and said:—"If we stand off a few points (which it is very desirable to do) we shall see the light of Cork harbour in about ten minutes open round that headland." The little cherub that sits up aloft may have whispered the same thing in other ears or, which is much more to be hoped, Captain Harrison pursued steady plans of his own—and so the helm was "ported," and in ten minutes from that time the light of Cork harbour appeared beyond the headland.

By the time night had set in, and the Irish coast had become invisible, the novelty of the voyage seemed to be wearing off. Enthusiastic men, who appeared to fancy that the fate of science was involved in every revolution of the Great Eastern's engines, went, it is true, from one engine to the other noting the number of turns made by them with a persistence which was most admirable, however useless their notes may be to them. And here I may say that a considerable deal of nonsense is practised, even by professedly scientific men, on such occasions. They act as if nothing but attention to certain superficial occurrences was requisite on their part in order to bring out all the questions which can possibly hang upon it. Whereas this is most certainly far from being correct. Many useful facts they can observe undoubtedly, and I for one gladly see them recording these; but a very little display is needed in their attainment, and the best scientific observers make no great show of their proceedings. But, apart from the gentlemen with note-books, the company lost interest in the voyage, and spent the early part of Sunday night in amusing themselves according to their several desires.

Monday was a thick and unpleasant day, and afforded but little interest to any one, until as noon was approaching the Welch coast was sighted. We had gone, (designedly, I hope,) considerably to the north of Holyhead, and after making a course "with some south in it" for an hour or more, saw first the rocks of Skerry. Holyhead itself, with the South Stack lighthouse, became visible very soon afterwards. Before entering the harbour experiments of some interest were made. Without detailing the circumstances attending them I may state their result, which was that either the paddles of the Great Eastern alone, or her screw alone, will propel the ship at a speed of from eight to nine knots per hour, the one propeller dragging or forcing the other bodily through the water at the same time. Hence, if any accident should occur to the one, the other may be relied upon to carry the ship to port, or even to her journey's end, without the use of a single sail. This is an advantage which no other passenger ship in the world possesses. How greatly it adds to her safety I need not explain.

At about three o'clock on Monday afternoon—with the pleasant but vexatious dinner bugle once more sounding most inopportunely—we steamed past the beautiful hill side of Holyhead. The colours of this hill, or mountain, are inexpressibly rich. The whole front of the rugged rock seems to have imbibed all the brightest and choicest colours that have streamed upon it from the sunsets of unnumbered ages; and as we past close beneath it in our wondrous vessel, one could not avoid feeling that however great and beautiful the works of man may become, God will not fail to keep him humble by the sight of other works of a greatness and beauty unapproachable by him.*

With this lesson impressed upon us our voyage came to an end. Of the efficiency and economy of the great ship as tested by the trip, I shall not be expected to speak here in any technical manner. So far as her efficiency is concerned—so far, that is, as her qualities as a sea-going ship have to be concerned—she has given perfect satisfaction to every one who is capable of judging her properly. Whether she will show any marked superiority to other vessels in point of economy, can scarcely yet be determined, so numerous are the things which enter into this question. There is reason, however, to believe that when tried by the only tests yet in existence as means of comparing steam-ships she will take very high, probably the highest, rank. R.

* Since the above article was put in type a paper on North Wales has appeared in the *Illustrated Times*, in which reference is made to the colours of the hills of that district in the following terms:—"Nowhere have I seen more glorious colours than those which play on the Welsh hills. Nature has formed these hills, surely, for the display of her art of colouring. In the main they are formed of limestone, but this is tinged with slaty mixture, whilst here and there pure slate peeps out. They are also metalliferous, and have in them lead, iron, sulphur, and I know not what besides; and all these metallic veins, as they show themselves on the hill-sides, or by staining the water which, oozing out of cracks and rifts, runs down in wayward streams over the surface of the rocks, wonderfully variegate their colours. And then, there is also the vegetation; the gorgeous heath, the brilliant yellow gorse, the mosses, and the fungi growing on every ledge and protruding from every cranny. Just fancy all this with the sun's meridian or slanting rays playing with alternate cloud shadows thereon! Sometimes to me it was so marvellous that "it seem'd the Heavens upbreaking through Earth."

THE ENFIELD RIFLE BAYONET.

The circumstances of the time justify us in devoting much attention to the production of warlike implements. Instead of cultivating the arts of peace, we are compelled to devote our studies to those of war. As if to prove that our boasted civilisation is but a sham, we are engaged, as are all our European neighbours, in the construction of every kind of man-destroying device that the mind of man can conceive, and await but the signal to turn them to dreadful account. This is a sad complexion of affairs among nations professing Christianity, and from whose altars for century after century its holy and peaceful precepts have been promulgated. It is sad, but, alas! it is true. It seems, indeed, from existing appearances, that nothing but a decided and overwhelming superiority of martial strength can save us—and we speak of England now—from the horrors of war, and that we are engaged in a race for mastery with at least one other great power of the earth. How painful soever, then, the task may be, it is necessary that we use with untiring energy the mental and the physical aids and appliances with which Providence as a nation has blessed us, in the production of death-dealing weapons. If it be a perversion of good gifts to employ them thus to apparently bad purpose, the people of England may console themselves, we think, with the consciousness that the fault is not theirs. Rifle corps are not required to protect our homesteads from internal, but external foes, and the "note of preparation" which is heard by day and by night in our arsenals and dockyards, is but the echo reverberating from beyond the channel. We do not in these days initiate war, but shall accept it as a dreadful necessity, if, unhappily, it come upon us.

Some thoughts of this nature possessed us lately when inquiring into the rate of progress made in the Government manufacture of small arms, &c., and they produced a depressing feeling. At Enfield the splendid mechanical arrangements for the manufacture of muskets are being strained to the utmost, and in London, Birmingham, and Belgium, contractors are engaged in supplementing the exertions there being made. Where this high pressure speed is to carry us—nationally speaking—it is impossible to say, we can only trust towards a safe terminus, and that the journey may be ended without an explosion! It may be remembered that not long since a description of the method of making an Enfield rifle *barrel* was published in our columns, and, as we have said, the interest on such matters is involuntarily on the increase, we purpose at present to pursue the inquiry into the mode of manufacturing other constituent portions of the rifle musket, commencing, for example, with the bayonet. The barrel is a dangerous weapon in the distance; the bayonet fearful in "close quarters." What is called the *blade* of the bayonet—the fluted, triangular, curved, bright, pointed, and handsome portion of the instrument—is made of the very best cast-steel which the art of man can produce from the natural iron. To commence with, the material to be wrought into this blade is 7 in. long and ¾ in. square. The round piece of best wrought iron for the socket, is, as it comes from the forge, 4 in. long and 1 1-16th in. in diameter. The steel to be presently "married" to the iron is, in the first instance, swaged down for the neck, leaving a swell at the bottom for welding to the socket. The working, indeed, is the next operation, and it is accomplished in the ordinary way, a little borax being used for fluxing. The amalgamated steel and iron is then taken to what is called a rider forging machine, when it is drawn out to the shape and size for machining, and has the flutings shaped to it. The machines do their mission next;

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they are fitted with top and bottom swages, and work at a very rapid rate. The bottom tools are adjustable as to height, and this allows for wear and tear. The slide which holds the top tool has a very strong spiral spring acting against it, always pressing upwards. The slides are driven down upon the work to be dealt with by means of eccentrics turned out of the solid steel driving shaft, which latter is furnished with a fly-wheel, and driven at an enormous speed. There are five slides to each machine, and the springs keep them up to the fans of the eccentrics. As in the making of the barrel there were various sized grooves in the rolls between which it is passed, so in the making of the bayonet are there various sized swages with which it is successively placed before being brought near to its final dimensions. Nasmyth's steam drop is now called into requisition—for hitherto the blade has been principally operated upon—and this affects the socket, which is driven forcibly into a pair of dies. The inspector of forged work now examines the article, and, if it meet his approval, it is annealed. Next it is put through a sharp cutting die in a power-press for the purpose of removing a wire edge thrown up in the action of stamping. So ends what may be termed the smith's part of the performance.

The first operation of machining a bayonet, is to pass the socket through a succession of mills which square the ends and bring it to the proper length, and this fits it for drilling—roughly. The bayonet socket drilling machine is peculiarly constructed, and is self-acting—at Enfield, that is—and it has a chuck attached to the rising table, and which "grips" the socket firmly, while being drilled with a twisted and self-clearing drill. One boy attends easily to several of these machines. Roughly drilled in this way, the bayonet is next chucked in a horizontal boring machine—similar to a surface lathe. A half round bit of the size of the exterior of a finished barrel, is now affixed to a slide rest and made, by a self-acting feed, to pass through the socket, the result being a very perfect bore. Several minor operations intervene, and a mandril being passed through the socket, the latter is turned outwardly from "neck" to "ring." The bayonet is next "set," and the blade cut to length. The neck, or curved part between the blade and socket, is turned in a lathe on the copying principle. The blade and socket are now put through a series of operations, such as milling, planing, and shaping in various parts, the bore of the socket being always the fixed point to work from. The grooves or flutings are cut by revolving mills or cutters, whilst the bayonet lies beneath them in a bed, and supported from end to end to prevent chattering. The machine being put in motion, a self-acting feed carries the bayonet forward, till the mill has traversed its entire length. Fairbairn of Leeds made the principal portion of these machines. The point of the blade is now formed, and then the neck is bent. This last process perhaps requires a little explanation. A small furnace is provided into which is introduced a blast, and on the top of which is fixed a slab of fire-clay perforated with six small holes. Through these holes when the neck of the bayonet is placed immediately above them, the flame by force of blast is made to pass. The result of course is that the neck becomes intensely hot. The heat being concentrated upon the part intended to be operated upon, namely, upon the centre of the neck, it is next taken to a machine in close proximity to be bent. This machine is fitted with a stud the exact size of the bore of the socket, and upon this stud it is placed, the blade being laid across the machine. Then there is a slide into which is geared a pinion for driving it forward. This slide is furnished with a roller turned out round the edge to the figure of the blade, which it comes in contact with in moving forward, and thus forcing the neck round a stud of given diameter until it comes to a regulated stop. The socket is thus brought to its proper position, and ranging, therefore, nearly parallel with the blade. When quite cold, it is struck with great force on an anvil, in order to test the soundness of the welding. The indentation caused by the blow is never afterwards removed, but suffered to remain as a proof of the testing.

The bayonet is now hardened, the heat being taken in a lead bath, which is kept up to a right degree of heat. When properly hot the implement of war is removed and immersed in a cistern of oil. It is next tempered and set to gauge by blazing it over a fire with oil. It is now tested throughout for strength and elasticity by springing it to the extent of 1½ inch. If it stands this ordeal and returns to its straight position, it is passed forward to undergo other operations, one of which is to cut out the "slot" for securing it to the foresight. This is done by aid of two machines—one of which is a small ordinary slotting machine. The socket is finally coined out to gauge so as to fit accurately the muzzle of the barrel. Now it is ground on the blade, and polished for the first time, and afterwards the neck and socket are browned by oxidation. The blade is next polished as brightly as a mirror, and after some few minor operations, the bayonet passes from the hands of the workman into those of the final inspector, who omits no effort to detect an imperfection. The chances are in the proportion of 96 to 4 that the inspector will pronounce it very good, and if so it is delivered to the storekeeper for delivery into service. It may not be amiss to say something of the locking ring by means of which, as our readers know, the bayonet is attached when finished to the barrel. It is of wrought-iron, roughly forged by hand in the first instance, and then struck while hot into a die under one of Colonel Colt's screw drops. This machine has a square-threaded screw passing vertically through its centre, and is supported on four pillars. The pillars act, also, as guides for the drop hammers to slide up and down upon. There are four hammers to each machine, and thus four men may be engaged at the same time with one machine. Each hammer is fitted with a section of a nut, which is self-acting by means of springs and catches, which alternately engage and disengage with the main screw, which is driven by gearing on the top of the machine. Any amount of fall may be given to the hammer, and one blow is usually sufficient to shape the locking ring. After this blow has been struck the ring is annealed, put under a vertical drilling machine, and bored and "rimered" out to the size of the outward diameter of the bayonet socket. It is then passed through several mills for the purpose of bringing it to the required gauge and exact figure, which being done, the hole is drilled and tapped for the reception of the screw. It is then slit through what is called the "lugs" by means of a circular saw. A little hand-labour, polishing on buff wheels, and prepare it still further, and then it is forced open to get it over the bayonet-socket. It is next blued by heating in charcoal, particular care being observed in keeping it perfectly clean by wiping with a dry rag and lime. And now the last operation comes, which is to "assemble" by carefully bending it on to the socket with a peculiarly constructed pair of tongs lined with leather, and a small box-wood mallet, care being taken not to screw it up too tightly, and it is fit for use. The total length of the bayonet when finished is 17¼ inches, and on the side facing the axis of the barrel, it is ⅜ inches across, tapering towards the end to ⅛, when it takes a sudden curve of about an inch in length, and is brought to a sharp point. Taking the section of the other angle it is about ⅛ths at the shorter end, and tapered to within about one inch of the point to measure ⅛ths. It is curved outward from the barrel to clear it from any action the flame might have upon it when the rifle is discharged, and it is "fixed." The groove of the wider side has a larger radius than that of the two narrower, leaving the edges about ⅛ in. thick at the lower end of the blade. The outward diameter of the socket is one inch and its length three inches, the nick is half-an-inch in diameter at its smallest part, and cone shaped for strength at its junction with the socket.

It is hoped that the foregoing description may make plain the *modus operandi* of bayonet forging and finishing, and that the instrument itself may hereafter be regarded with more interest—mechanically speaking—than before that description was given. It appears to be a simply-made weapon, but its manufacture is evidently somewhat complex. Like all other parts of the Enfield rifle, its parts are interchangeable, and any bayonet and locking ring will fit any musket made at the Government works.

Contractors have not as yet, from want of machinery and appliances, been able to supply rifle muskets of an interchangeable character, nor yet at as cheap a rate as those prepared at Enfield. Birmingham has striven to accomplish these desiderata but has hitherto signally failed, and as at the first-na ned place, from the vigilant activity of Colonel Dixon and his officers, there are continual improvements being made in the machinery department, it is most likely that Birmingham, with all its "go-a-head" competitiveness, will lag behind in the race for some time longer.

Literature.

A Manual of Naval Tactics: together with a brief Critical Analysis of the principal modern Naval Battles. By JAMES H. WARD, Commander U.S.N., Author of "Ordnance and Gunnery," and "Steam for the Million." D. Appleton and Co., New York, and 16 Little Britain.

THIS is, we are informed, a primer or first book, for the purpose of making the study of naval tactics easier and more inviting. It consists mainly of a digest of standard works on the subject, and of original analyses of some of the most famous sea-fights. It was written while the author was "in command of a corvette on the coast of Africa, where it served to beguile leisure, and relieve the tedium of service in that torrid region."

The choice of such a pastime in that horrid region was laudable enough, especially as it gave the author an opportunity of dedicating a book to Governor Toucey, the Honourable Secretary of the Navy, but the book itself seems to us to be without merit of any kind.

The first section describes the "orders of sailing," and the manœuvres of sailing fleets. The second treats of engagements under sail. The third, of engagements between fleets at anchor. These, with the conclusion, occupy 127 pages.

Then follows the fourth section, consisting of nine pages on "Tactics under Steam."

The excuse for writing such a book in this day of steam fleets is that "as officers, notwithstanding steam, must still be seamen, and understand the art of manœuvring a single ship under canvas, so also must they continue to study the art of manœuvring an assemblage of ships under canvas—in other words, naval tactics as here presented. And, on the contrary, when officers need no longer be seamen, neither will they need any longer to understand tactics under sail." Commander Wood says that "the language has been graced" by Sir Howard Douglas' "Naval Warfare with Steam." We are sorry that it is so utterly impossible to pass the same compliment upon him. Some of his writing is very discreditable; take the following sentence for example:—"In the British and French naval operations for the last hundred years, the latter—a chivalrous, yet not so decidedly a maritime nation—appears from policy to have adopted the practice of gaining the wind to avoid decisive engagement; and the former, for very obvious reasons, the reverse—that is, for position to attack." And in describing the battle of Camperdown, he says:—"Admiral Duncan's action (Lord Duncan in consequence) was fought in 1797, against a Dutch fleet, off Camperdown, coast of Holland," "with a most brilliant and decisive result," "for notwithstanding close to their own coast, but few of the Dutch escaped." His thoroughly Yankee style of criticism is very amusing. See how he opens fire upon poor Lord Nelson with reference to his general orders issued from the Victory, off Cadiz, October 18th, 1805, *i.e.*, on the eve of the battle of Trafalgar. One of

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the clauses of these orders, which he gives entire, runs thus:—

"The impression of the *whole* British fleet must be made, with the intention of overpowering it, on that *portion* of the enemy's line rearward from the third or fourth ship ahead of its commander-in-chief, presumed to be in the centre. I will suppose the twenty enemy's ships ahead of this point in the line to remain untouched. It would be some time before they could manœuvre to bring their force compact to attack any part of the British fleet, or succour their own rear, and it would be impossible without mixing with the ships engaged."

Here our author breaks in within brackets:—"Well! pray if one party mixes, doesn't the other get mixed? Whatever the evils, certainly they attach equally to one party as to the other. One loses patience with the idea that all evil is on one side, an idea which seems to have always engrossed both the English and their European enemies."

The following remarks are interesting as an American view of our naval position and duties:—

"But whatever is to be the constitution of the future fleet, it must not be forgotten that from the days of ancient Rome to those of modern England, from Actium to Lepanto and Trafalgar, the empire of the world has depended upon and followed, and has been lost and won with, the empire of the seas; and that this empire always has been, and always will be, contested with large fleets, little influenced by the guerilla fighting of single ships. Comprehensive minds, therefore, in devising naval construction, will look to such a combination of ships as shall produce the most effective fleet in this great contest for dominion which must one day come off—none can tell how soon. Not that fleets should be held in preparation, or even constructed, for so indefinite an event; for it is idle, as it is unreasonable, to look in a continental nation as the United States for the living perpetual interest and favour with which an insular people, like those of Great Britain, cherish their wooden-walled defences, and patiently endure the burdens they entail. But such a degree of experimental construction as will determine the best types is judicious; because with men, money, and material at command, it renders the problem of sudden and indefinite increase in the number of ships of easy and safe solution in the event of war. And however politic or fashionable it just now is to laud the actual construction in France as evidence of her comparative naval strength, it is in reality *resources* for building, equipping, and manning ships, in which England vastly excels, that gives to her, or to any nation possessing them in the greatest degree, a true and actual maritime ascendancy."

We think the subject of naval tactics is at this moment of the very first importance, and ought to occupy the attention of the Government. While the Board of Admiralty still remains inert, and gives no sign, in spite of all Sir Howard Douglas' adjurations, the French Ministry of Marine has prepared an elaborate system of tactics for steam warfare, and is carefully instructing in it the men who may one day dispute with us the sovereignty of the seas.

Proceedings of Societies.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary meeting *October 4th*, 1859.—William Fairbairn, Esq., F.R.S., &c., President, in the chair. The President delivered an address on the occasion of the opening of the session. He commenced by adverting to the loss which had been sustained by the Society by the death of two of its ordinary and two of its honorary members. Mr. Laurence Buchan, the oldest member of the Society, died at the advanced age of eighty-four years. Mr. John Ashton Nicholls, F.R.A.S., was suddenly called away in the prime of life. The honorary members who have passed away are Alexander von Humboldt and the Rev. William Turner. The President reviewed the past history of the Society, pointing out what had been accomplished by the members, and the path still open for successful scientific research. He adverted to the great advances made in recent times in all the departments of knowledge. In conclusion he congratulated the Society on its prosperous state, and expressed the fullest confidence that the members would, by their contributions to literature and science during the present session, fully maintain its reputation. The thanks of the Society were voted to Mr. Fairbairn for his excellent address.

Dr. F. Crace Calvert presented, on the part of Mr. Arnaudon, of Turin, a paper containing "Researches on several Organic Colouring Matters."

A paper by Mr. John Smith, M.A., was read by his brother, Dr. R. A. Smith, entitled "On the cause of Colour and the Theory of Light." The author, in attempting to explain certain natural phenomena, could not satisfy himself by applying the principles of either theory of light. A series of experiments was subsequently undertaken, which led to the conclusion that varieties of colour are produced by pulsations of light and intervals of shadow in definite proportions for each shade of colour. That is, supposing white light to consist of the motion of an ether, blackness to consist of entire absence of motion, then a certain colour, blue, red, or yellow, will be produced by the alternate action of the light and the shadow. The author used shadow in the positive sense as the sensation was positive. He considered that his theory gave an entirely new and simple explanation of the phenomena of refraction through the prism, and summed up as follows:—"The experiments prove the homogeneity of the ether. They prove the undulatory hypothesis, but oppose the undulatory theory. They enable us to dispense with the different refrangibilities of the rays of light, as taught by Newton. They help to explain many of the phenomena of what is called the polarization of light. They give a new explanation of prismatic refraction, and explain in a plain and simple manner many very interesting natural phenomena." Startling, he said, as these conclusions are to those who are conversant with the subject of light, he thought he was perfectly warranted in drawing them from his experiments. The general process of reasoning could not, however, be given in a short abstract.

MEETINGS FOR THE ENSUING WEEK.

Tuesday.—*Geological Society.* Papers to be read,—1. On the passage-beds between the Upper Silurian into the Old Red Sandstone at Ledbury, Herefordshire. By the Rev. W. S. Symonds, F.G.S. 2. On the Coal Formation at Auckland, New Zealand. By Henry Weekes, Esq. 3. On the Geology of Vancouver's Island. By W. Bauerman, Esq.

EXPERIMENTAL RESEARCHES TO DETERMINE THE DENSITY OF STEAM AT ALL TEMPERATURES.

By Wm. Fairbairn, F.R.S., and Thos. Tate, F.R.A.S.*

I propose to give a short sketch of an apparatus, and the results of the earlier experiments which, in conjunction with my friend Mr. Thomas Tate, I have been investigating by direct experiments, with the intention of determining the law of the density of steam and other condensable vapours; and thus to solve a hitherto almost untouched problem by an experimental method, which will verify or correct the theoretical speculations in regard to the relation between the specific volume and temperature of steam and other vapours. The experiments are being conducted, it is believed, upon an entirely novel and original principle, and one which is applicable at any temperature and pressure capable of being sustained by glass vessels.

For a perfect gas, the law which regulates the relation between temperature and volume is known as Gay-Lussac's or Dalton's law, and is expressed by the equation:—

$$\frac{V \times P}{V_1 \times P_1} = \frac{458 + t_1}{458 + t} \quad \ldots\ldots (1).$$

Now, density of steam has been determined with accuracy by direct experiment at the temperature of 212°—and at that temperature only—by the method of Dumas. At 212° Fahrenheit its density is such that its volume is 1,670 times that of the water which produced it. Hence, assuming Dalton's law to hold for steam, and substituting these values of volume, temperature, and pressure, we get for the volume of steam from a unit of water at any other temperature:—

$$V = \frac{1670 \times 15}{670} \times \frac{458 + t}{P},$$

$$\text{Or, } V = 36\tfrac{1}{3}\,\frac{458 + t}{P}, \quad \ldots\ldots\ldots (2).$$

These are the well-known and received formulæ from which all the tables of the density of steam have hitherto been deduced, and on which calculations on the duty of steam-engines have been founded. Up to the present time, however, this formula has never been verified by direct experiment, nor are the methods hitherto employed in determining the density of gases and vapours applicable in this case, except at the boiling temperature of the liquid at the ordinary atmospheric pressure. But, on the other hand, theoretical speculations throw considerable doubt on the accuracy of the above formula when applied to steam and other condensable vapours. Several years ago, Dr. Joule and Professor William Thomson announced, as the result of applying the new dynamical theory of heat to the law of Carnot, that for temperatures above 212° Fahrenheit, there is a very considerable deviation from the gaseous laws in the case of steam. Later, in 1855, Professor Macquorn Rankine has given a new theoretical formula for the density of steam, independent of Gay-Lussac's law, and confirmatory of Professor Thomson's surmise. But as yet these speculations need the evidence and verification of direct experiment.

The density of steam is ascertained by vapourising a known weight of water in a glass globe of known capacity, and noting the exact temperature at which the whole of the water becomes converted into steam. From these three elements,—volume, weight, and temperature—the specific gravity is known. But in pursuing this method, these two difficulties must be overcome. First, the pressure of the steam renders it necessary that the glass globe should be heated in a strong and consequently opaque vessel. Second, as steam rapidly expands in volume for any increase of temperature beyond the temperature of saturation, it would, in any case, be impossible to decide by the eye the temperature at which the whole of the water became vaporised. The temperature of saturation, or temperature at which the whole of the moisture is converted into steam, whilst no part of the steam is superheated, must be determined with the utmost accuracy, or the results are of no value.

The difficulties thus resolve themselves into finding some other test of sufficient accuracy and delicacy to determine the point of saturation. This has been overcome by what may be termed the saturation gauge; and it is in this that the novelty of the present experiments consists.

To illustrate the principles of the saturation gauge, suppose two globes *A* and *B*, Fig. 1 (next page), connected by a bent tube containing mercury at *a b*, and placed in a bath in which they can be raised to any required temperature. Suppose a Torricellian vacuum to have been created in each globe, and twenty grains of water to have been added to *a*, and thirty or forty grains to *B*. Now, suppose the temperature to be slowly and uniformly raised around these globes; the water in each will go on evaporating at each temperature, being filled with steam of a density corresponding to that temperature, and the density being greater

* British Association, 1859.

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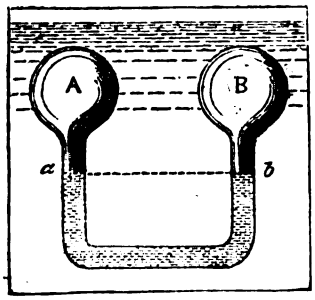
Fig. 1.

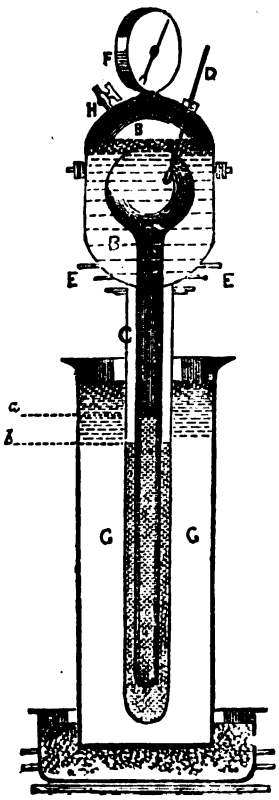


as the temperature increases. At last a point will be reached at which the whole of the water in globe *a* will be converted into steam, and at this point the mercury column will rise at *a* and sink at *b*; this is the saturation test, and the cause of its action will be easily seen. So long as vaporization went on in both *A* and *B*, and the temperature was maintained uniform, each globe would contain steam of the same pressure, and the columns of mercury, *a* and *b*, would remain at the same level. But so soon as the water in *a* had vaporized, and the steam began to superheat, the pressure in *a* would cease to remain uniform with the pressure in *B*, and the mercury column would at once fall, and thus indicate the difference. The instantaneous change of the position of the mercury is the indication of the point at which the temperature in the bath corresponds with the saturation point of the steam in *a*.

To show the delicacy of this test, I may instance that at 290° Fahrenheit, the mercury column would rise nearly two inches for every degree of temperature above the saturation point, as the increase of pressure arising from vaporization is twelve times that arising from expansion in superheating at that point, and a similar difference exists at other temperatures.

The apparatus, as employed for experiment, varies according to the pressure and other circumstances of its use. Fig. 2 represents one of the arrangements which has been employed with success. It consists of a glass globe of about seventy cubic inches capacity, in which is placed, after a Torricellian vacuum has been formed, the weighed globule of water. The globe with the stem is shown at *A*; this is surrounded by a copper boiler *B B*, prolonged by a stout glass tube *C C*, enclosing the globe stem. This copper boiler forms the water and steam bath through which the globe is heated, and in fact corresponds to the second globe *B*, in the former figure. The fluctuating mercury column, or saturation gauge, is placed at the bottom of the tube *C C*, and the saturation point is indicated by the rise of the inner mercury column *a*, and the fall at the same time of the outer mercury column *b*. As soon as the whole of the water in the globe *A* is evaporated, there is an instantaneous rise of the inner mercury column to restore the balance of pressure, and that progressively with the rise of temperature.

Fig. 2.

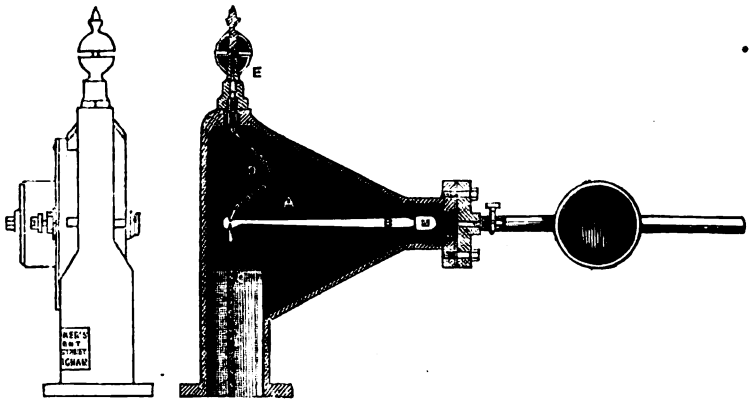


As an auxiliary apparatus the boiler is provided with gas-jets, *E*, to heat it, and with an open oil-bath *G* to retain the glass tubes at the same temperature as the boiler, and this oil bath is placed on a sand bath, and also heated with gas. A thermometer *D* registers the temperature, and a pressure gauge *F* the pressure of the steam; and a blow-off cock *H* serves to reduce the temperature when necessary. A number of results have already been obtained, but they are not yet sufficiently advanced to be made public. The following numbers have been, however, approximately reduced from the theoretical formula above, and the experimental results may illustrate the use of this method of research. The most convenient way of expressing the density of steam is by stating the number of volumes into which the water of which it is composed has expanded. Thus one cubic inch of water expands into 1,670 cubic inches of steam at 212° Fah., into 882 cubic inches at 251°, and into 400 cubic inches at 304°, and so on; in this way the following numbers have been computed:

Temperature	Volume of Steam. By Formula.	By Experiment.
244°	1,005 ...	896
245°	969 ...	890
257°	790 ...	651
262°	740 ...	680
268°	680 ...	633
270°	660 ...	604
283°	540 ...	490

These determinations at pressures varying from ten to fifty lbs. above the atmosphere, are not accurate reductions from the experimental results, but only approximations. But they uniformly show a decided deviation from the law for perfect gases, and in the direction anticipated by Professor Thomson, the density being uniformly greater than that indicated by the formula. I hope by the time of the next meeting of the Association, with the assistance of my friend Mr. Tate, to be enabled to lay before the section a series of results which will fully determine the value of superheated steam, and its density and volume as compared with pressure at all pressures, varying from that of the atmosphere to 500 lbs. on the square inch.

WALKER'S PATENT FRICTIONLESS STEAM BOILER FLOAT.



WALKER'S PATENT FRICTIONLESS STEAM BOILER FLOAT.

Simplicity of arrangement is of vital importance in all boiler fittings. The lives of so many depend upon them that we receive all real improvements in their construction as matters of considerable importance. The old stone float, with its counterbalance weight, its suspension rod, gland, and steam-tight packing, the friction of which materially impairs the certainty of its action, is for this reason a doubtful indicator, and should never be used in its old form without the boiler to which it is fitted having an adjunct in the shape of a glass gauge. Were it not, however, for this objection of friction the float in question would be all that we could desire as an indicator. Mr. Walker, of Birmingham, has in a very simple manner overcome the difficulty, and produced a remarkably sensitive float. It has now been in action some time, and has never been known to fail, so that we have confidence in laying it before our readers as a practically good thing.

Walker's patent frictionless float consists of a lever enclosed in a cast-iron box made in the form of a segment of a circle. The end of the lever on which it vibrates is fitted with a spindle, which passes through one side of the box, and carries on its outside end another lever extending in a line with the inside one as a pointer, and the other way to receive a weight to balance the float. To the vibrating end of the lever situated inside the box is attached a copper chain, which passes down a pipe bolted to the top surface of the boiler, and forming a standard to the segmental box; to the lower end of this chain is suspended the float of ordinary form. The chain is also carried up from the internal lever to a brass plug, which forms a valve at the lower end of a whistle situated at the top of the segment. When the water is the right height in the boiler the chain hangs loose, but if it falls too low the tension pulls down the plug or valve, which is held by a spring in its place, and an alarm is sounded. On referring to the engraving of the sectional elevation, the various parts will be seen in position; *A* shows the segmental box, *B* the internal lever, *C* the chain leading to float, *D* chain leading up to whistle valve, *E* the whistle and valve, *F* the external lever and balance weight, with the external pointer in a line with the internal lever.

By the side of this section is an end elevation, which completes the delineation.

Arrangements for the reception of the Great Eastern, which is expected to arrive at Southampton from Holyhead early next week, are in active progress. As stated in the *Times* of this morning, the moorings will be furnished from Portsmouth dockyard by Admiralty order, and they will be laid down off Fawley beacon, about four miles down the Southampton Water, where the great ship will have plenty of room to swing freely at all times of tide. The anchors, blocks, chains, pendants, and bridles to form the moorings for the great ship in Southampton Water, were yesterday selected in Portsmouth Dockyard, and will this morning be shipped on board a Government lighter for conveyance round.—The *Times*, Thursday.

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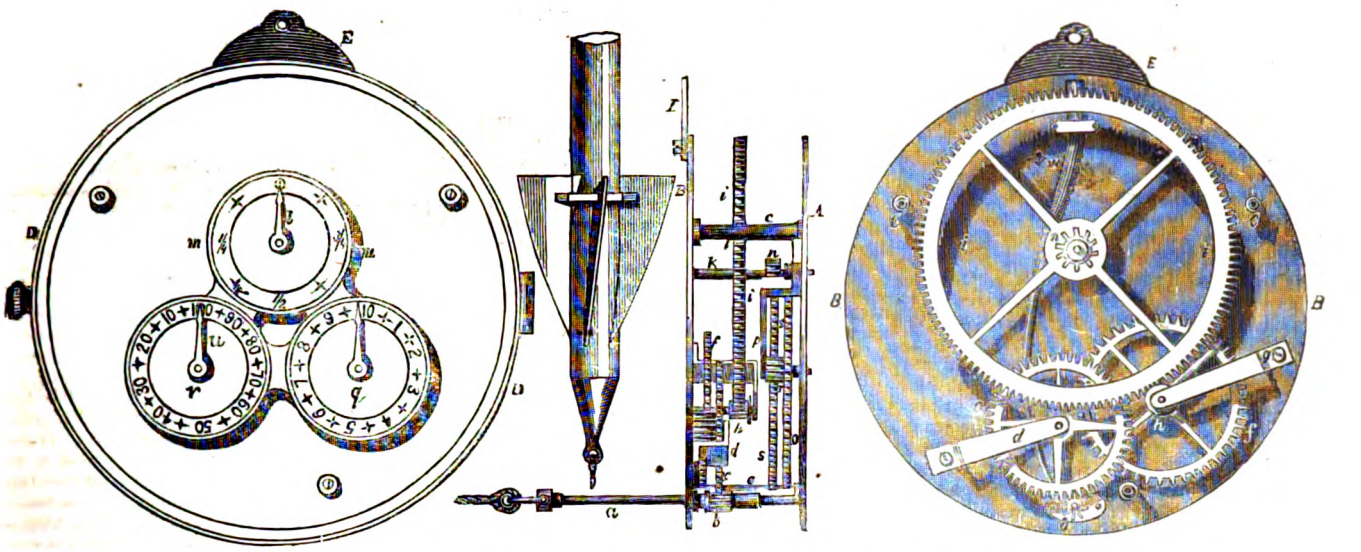
TYSSEN'S APPARATUS FOR INDICATING THE SPEED OF SHIPS.

Fig. 1. Fig. 4. Fig. 3. Fig. 2.



TYSSEN'S APPARATUS FOR INDICATING THE SPEED OF SHIPS.

Mr. Jacobus Tyssen, of Rotterdam, in the kingdom of Holland, mariner, has just patented in this country an "An Improved Apparatus for Indicating the speed of Ships and other Vessels." He fits inboard on the axis of a three-bladed screw which is placed outside the vessel a wheel which gears into one or more wheels, and causes the last in the train to make, say, one revolution when the vessel is progressing at the rate of ten knots an hour, which revolution is shown upon an indicating dial. He does not confine himself to wheels made to work and show this speed only, the invention consisting in indicating by means of registering wheels placed inboard, the revolutions of a screw working in the water fitted on the axis of the first wheel in the train, the train of wheels being set to show so many knots per hour on the indicator according to the revolutions of the screw in the water. Fig. 1 of the accompanying engravings is an exterior front elevation of an apparatus for indicating the speed of ships and other vessels constructed according to this invention; Fig. 2 is a view with the front plate removed; and Fig. 3 is a side elevation of the apparatus with the exterior case removed. *A B* are two metal plates held together by rods *C C C* secured to the front plate by washers and screws as shown. The plates *A B*, with the mechanism they hold between them, and about to be described, are placed in an outer case *D*, which is suspended by a lug *E* to the side of a ship's cabin, or the stern of a vessel, on deck, or in any other convenient position. *a* is the main spindle, from which the whole motion is derived; the outer end of this spindle carries a link and eye to which a line is attached, which line carries at its extremity a three-bladed screw, a view of which is given at Fig. 4, but the patentee does not limit himself to this form of blade. As the vessel moves through the water, this screw revolves, which through the line attached to it gives motion to the spindle *a*, and this through wheels and pinions indicates on a dial or dials the speed at which the ship is travelling, as is about to be explained. The spindle *a* carries a pinion *b*, which gears into a wheel *c*, supported by a bracket *d* screwed to the back plate *B*. The shaft that carries the wheel *c* also carries a pinion *e*, which gears into a wheel *f* containing the same number of teeth as the wheel *c*. This wheel *f* is supported by a bracket *g*, and the shaft which carries the wheel *f* also carries a pinion *h* that gears into a wheel *i* on a shaft *k*, which carries a pointer *l* that revolves round a dial plate *m*, which when it has made one revolution shows that the ship has run one knot. The shaft *k* also carries a pinion *n*, which gears into a wheel *o* on a shaft supported by a bracket *p* screwed to the front plate *A*. This shaft carries a pointer that revolves round a dial plate *q*, and indicates when the ship has run from one to ten knots. The shaft which carries the wheel *o* also carries a pinion *v* that gears into a wheel containing the same number of teeth as the wheel *o*. The shaft which carries this wheel *s* is supported by a bracket screwed to the front plate *A*, and carries a pointer *u* that revolves round a dial plate *v*, and indicates from ten knots to a hundred the distance the vessel has run; *w* is a tube for the passage of oil to lubricate the spindle *a*. The patentee has shown the apparatus to indicate up to a hundred knots the distance a ship has run, but without departing from the invention the apparatus can be arranged to show any other number.

ROBERTSON PATENT CHAIN-PROPELLER.

By Mr. Peter Spence.*

At the request of the patentee and several gentlemen engaged in bringing this invention into practical operation, I have undertaken to give a short description of it to the mechanical section of the British Association.

As mechanics is a department with which either theoretically or practically I am only very slightly acquainted, I hope the members of this section will look charitably on my efforts if I fail in giving a lucid description of what seems to be an invention displaying considerable ingenuity, and of great practical importance.

It is well known that great efforts have been made to adapt steam power to the conveyance of both passengers and goods on canals, but although the failure of most of these efforts is apparent, from the fact that on a very few canals is it at this moment employed, yet there seems no reason to doubt that if steam power can be made to suit itself to the peculiarities of canal navigation, it will be found, as in every other department of mechanics, the cheapest and most convenient agent.

In 1831, when the first efforts seem to have been made to employ steam power on canals, Mr. Fairbairn, who then engaged in an extensive series of experiments by which much valuable data was elicited, recommended for this purpose a peculiar form of steam-boats with paddles in the stern; but however well these boats might otherwise have fulfilled the design, the surge from every form of paddle steam-boat was no doubt the fatal barrier to their adoption. When, at a later period the screw was adopted as a propeller, this seemed to meet the difficulties of the case, and screw-propelled boats have to some extent been adopted and are now in use: but even the screw has been found only applicable to the few canals which are of considerable depth; and in these the danger always exists of a disturbance producing a disintegrating effect on the sides and bottom of the canal, and where, as in the majority of canals, the depth does not exceed three to four feet, the working of the screw is found to be altogether impracticable.

The invention of Mr. Robertson fully meets and obviates these difficulties arising from the use of both the paddle and the screw, while it possesses advantages in obtaining the full effect of the power applied, which are apparent at once. In whatever mode power is applied to the propulsion of vessels in water, by the paddle or screw, there is a great loss of power, only a part being productive and the remainder wasted. For example, when the paddle is just entering the water on the one side, and leaving or emerging from it on the other, the powers expended in these actions only neutralise each other, and contribute nothing to the propelling of the vessel. So great is the loss of power in some circumstances, that one authority gives the following example: suppose a boat propelled in a stream, the power being affixed or applied to a cylinder, on which a rope is wound, the other end of the rope being attached to a fixed point at some distance up the stream or on shore, and that the power is afterwards applied by paddles in the stream; it will, he says, take three times the motive power in the latter case that it does in the former to propel the vessel at the same speed. This, I think, must be an exaggerated estimate; but it clearly proves the great loss of power in certain cases, and the probability that it is considerable in all.

The peculiar principle of Mr. Robertson's invention is, that he applies the power by dragging the vessel from a fixed point, and its great ingenuity is, that the fixed point is at the same time a moveable one, a constantly fixed point in relation to the power exerted by the engine in propelling the vessel, and a constantly changing point in relation to the course on which the vessel is being propelled. The construction of the propelling apparatus is as follows:—At or near the bows of a boat, say 70 feet long, is placed a steam-engine, the main shaft of which crosses the bows of the vessel at or about the level of the deck; a

* British Association, 1859.

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fixed pulley is attached to each end of this shaft, these pulleys projecting over the sides of the vessel; they are three feet or more in diameter, and on their periphery have a hollow or groove to receive the chains which are to run over them; they are also so constructed as to take a firm hold of the chains as the power is exerted in dragging the chains over the pulleys. On the other or the stern end of the boat are two pulleys, also projected over, one on each side; these are loose, so that the chains merely run over them. Friction rollers are also placed along each side of the vessel, to carry the chains as they pass from the stern to the bows of the vessel; the chains, which are endless, pass or are dragged over fixed pulleys at the bow of the vessel, and falling down lie along the bottom of the canal, and thus become the fixed point or lineal anchor on which the power acts; the action of the engine in dragging the chain over the loose and fixed pulleys being necessarily to drag or propel the boat forward. Every yard of the chain passed over the pulleys representing a yard of space that the boat has progressed in her course—the fixed point or length of chain lying at the bottom of the canal still remaining the same, what is taken up at the stern being replaced by exactly the same length deposited at the bows. The speed of the vessel is thus exactly equivalent to the speed and size of the driving pulleys, unless, indeed, there should be any slip of the chain in passing over them, and this in practice is easily prevented, and is again exactly measured by the velocity of the chain, unless there should be a slip of the chain along the whole length over the bottom of the canal, and this, of course, is a mere matter of the weight of the chain. In repeated trials which have been made before thousands of spectators (and in more than one of which the writer was on board), in a boat 70 feet long and 7 feet wide, the chain used was only 20 lbs. per yard, or 40 lbs. per yard for the two chains, 22 yards of double chain being always at bottom; this gives a weight or resistance of 880 lbs. in this case as the fixed point. From the data ascertained by Mr. Fairbairn, that in tugging vessels the average pull of a horse was 94 lbs., the fixed point in these trials would exceed nine horses' power, and an engine power of nine horses could therefore be exerted without the chain slipping over the bottom of the canal. The speed attained ranged from four to six miles per hour, and nothing more was attempted at that time; the motion was easy and regular, the facility for starting equal to either screw or paddle, and the power of stopping quite peculiar. The moment the engine stops she drags at anchor, and the momentum is absorbed before the vessel has proceeded one-half of her own length. The weight of chain can be doubled or quadrupled without inconvenience, and the capability of using increased power to any extent be afforded as required. The weight of chain when increased does not materially increase the loss of power, as the power expended in raising the chains at the stern is neutralised by the weight of the falling chain at the bows, the only loss of power being the friction on the pulleys and friction rollers as the chains pass from stern to stem of the boat above water, and that must be so trifling as not to merit calculation. The invention is not limited in its application to canals, but is suited to rivers where occasional shallowness may render either paddles or screw useless, or where a strong current would prevent any amount of power being got except at an enormously increased and therefore impracticable speed. No additional speed but only an additional power would be required by the chain propeller to stem the strongest current, and however shallow, if the boat will float the propeller will work.

It is almost needless to add that the working of the chain gives rise to none of that commotion in the water that constantly attends the working of both paddles and screw; the chains rise and fall without the least perceptible agitation of the water, and even the ordinary wave from the bow of the boat is cut in pieces by the falling chain and reduced to the merest ripple.

THE DEEP-SEA PRESSURE GAUGE.

By Henry Johnson Esq.*

The few experiments which I have made on the compressibility of water by pressure, show a greater than indicated by Mr. Carston of 1 in 21,740 for the pressure of one atmosphere. The method adopted is that of subjecting to the pressure of a column of mercury a bulb of water on the short end of an inverted glass syphon, containing eight ounces of water, ninety-nine parts in the bulb and one part on the tube, which is divided into 100 degs, so that each degree is of the whole 1-10,100th part, and the pressure of each 30 in. of mercury caused a compression of rather more than 1 deg. in fresh water, and about ¾ of a degree in sea water. The result varied a little owing to the effect of slight variations of temperature on the bulb. This difference of result, however, does not affect the principle of the instrument. The compressibility of water is too minute to be recorded in a simple tube, but it may be recorded in two methods; one, with a bulb or bottle and a tube accurately divided, the tube being furnished with an index to be pushed along the tube by a cork or elastic piston isolating the water in the vessel, and travelling along the tube towards the bulb during the descent until the isolated water became equally dense with the water surrounding it, and when pushed back in ascending by the expanding water in the bottle, leaving behind the index to mark the degree of compression, a small aperture at the end of the scale allowing the escape of the air confined by the cork or elastic piston. The instrument to be fastened to a line with the piston downwards, so that the isolated water, being lighter than surrounding water, should press upwards against the tap rather than towards the piston. Another method of applying the principle has, however, been adopted on the suggestion of Mr. F. Hoffman, who made the instrument; namely, to have a tube or cylinder of metal, and in lieu of a scale tube, to use a long bolt of metal, or, in other words, a long solid metal piston to enter the cylinder through a packing box, and to be pressed into the cylinder by the external pressure of the superincumbent water. In descending the piston, when pressed into the cylinder until the density of the isolated sea water equalled that of the sea water surrounding it would draw along an external scale an index recording the compression; and on ascending, the piston, when pushed back by the expansion of the isolated water, would leave in its position the index fixed by a spring acting on a toothed rack at the side of the scale. In this form the action of the instrument appears to be very simple—the piston being pressed into the cylinder, or out of it, according to the relatial density of the water in the cylinder and of the water surrounding it; and resemble the action of some other hydraulic presses, although this instrument is worked by the pressure of the sea, and others by the hydraulic pump. After a correction for the effect of the friction upon the piston in the packing box, and which is considerable, the instrument appears to record the density or compression of the sea water surrounding it—and consequently the pressure to which telegraph lines would be subjected at the same depth.

An experiment of great interest might be made by sending down with this instrument a deep sea thermometer, and deducting from the total amount of compression, the compression resulting from variation of temperature between the temperature of the water and the surface and at extreme depths, and comparing the balance of compression with the depth as indicated by careful soundings, or with some approved instrument, as, for instance, Massey's sounding instrument. Some further experiments will be required to ascertain the effect of variation of temperature on the capacity of the cylinder; and any correction that may be necessary. An endeavour has been made to demonstrate practically the compression of water by screwing a small cross-bar into the end of the piston and attaching weights to it, but as the instrument is without the support of the external pressure of the sea water, which would balance the internal pressure, and has not been strengthened for the present experiment, this experiment must be considered not as an exact experiment, but simply as an illustration of a principle; the amount of compression being greater than that indicated by the previous experiments.

The vessel is made of cylindrical form in order to allow some length for the piston and scale, and it contains exactly 10 ounces of water. The piston is of such a size that 26 in. would displace one ounce of water, and is divided into 100 principal degrees, which are subdivided, each principle being 1-1000th part. Of this length a portion of 40 deg. (about 10 in.) has been taken, so that this instrument can record compression up to the extent of 40 parts in a thousand. A spanner accompanies the instrument, to unscrew or tighten the packing box when necessary; the other end of the spanner fits into and turns a tap at one end of the cylinder, the interior of which is oval, and the tap has a small air channel to allow the escape of air, so that the cylinder may be filled quite full of water. The instrument may then be placed in the accompanying stand, and the cross bar screwed on to the piston, and weights attached to the cross bar showing pressure after deducting the weight of the two 2 lb weights, together 4 lb., which are required to overcome the friction on the piston in the packing-box, when the cylinder is empty. The spring should be relaxed, and the index pressed down a little, and afterwards pushed up to the piston to prevent the friction of the index from affecting the experiment. If the two 5 lb. weights, together 10 lb., are used after deducting the 4 lb. for friction, a pressure weight remains of 6 lb. The diameter of the piston being ⅛ths of an inch, the area is about ⅛ths part of a square inch, and the pressure of the 6 lb. upon the piston is thus equal to a pressure of 84 lb. per square inch.

It is to be hoped that after some further experiments to ascertain the effect of variation of temperature upon the capacity of the cylinder, and any correction that may be required, that the instrument will be found practically useful.

* British Association, 1859.

ON THE TRUE ACTION OF WHAT ARE CALLED HEAT-DIFFUSERS.

By Arthur A. Taylor, of Marseilles.*

Mr. Wye Williams and others have found that an increased effect was produced by the fuel burnt in steam boilers when what have been called heat-diffusers were placed in the tubes or flues. The apparatus in question consists generally of matallic bands or ribands twisted into spirals or bent in the direction of their length into zigzag forms, and placed in the tubes or flues, the professed object of this addition being to break up or disturb the current of heated gases passing through the tubes, and to cause every portion of the gases to inpinge on the heating surfaces. The cause given for the increased effect produced being, that when a current of heated gases passes through a tube under ordinary circumstances, only the exterior portions of the columns come in contact with the sides of the tube, and that in thus disturbing the current by obstacles to its direct course, a more perfect contact of the gases with the surfaces is produced. The question which I wish to raise is, whether this is the true explanation of the effect produced by diffusers, deflecting bridges, &c. I think it can hardly be admitted that each molecule of a gas passing through a tube follows a course parallel with the axis, for those in contact with the sides of the tube will be so impeded by friction as to have a much slower motion than those in the centre, just as in a river the current near the banks is less rapid than that in the middle of the stream; and, that as in the river, so in the tube, a series of eddies will be formed, tending to bring all portions of the gas in contact with the sides of the tube. This peculiar motion of gases in a tube may very clearly be observed in the smoke issuing from the funnel of a

* British Association, 1859.

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steamer, the smoke retaining the eddying motion which it had in the funnel for some time after leaving it. These considerations led me to consider the mere disturbance of the currents as inadequate to explain the increased evaporation observed, and to attribute it to a very different cause. Gases do not radiate the heat which they contain, so that the only mode in which a gas can communicate its heat to a surface is by contact or connection. This is in the present practice the only mode in which those heating surfaces of a boiler, which are not exposed to the radiation of the fire or flame, can abstract heat from the products of combustion; but if in a flue or tube a solid body be introduced, it will become heated by contact with the gases, and will radiate the heat thus received to the sides of the flue. Now these diffusers, &c., exactly fulfil these conditions, and I, therefore, attribute their effect mainly, if not entirely, to the function which they must fulfil in absorbing heat from the gases by contact, and then radiating this heat to the sides of the tubes or flues, and I think it will be admitted that the amount of heat thus conveyed to the water may be very important, when it is considered that the temperature of the gases in the tubes of a boiler at 5 in. or 6 in. from the fire-box tube-plates is about 800 deg. Fah., and that these radiators will consequently have a temperature of several hundred degrees above that of the surfaces in contact with the water in the boiler, and that a very active radiation must consequently take place from one to the other. This principle once established, the modes of application in pratice are, of course, endless, and I will only mention that I do not see any advantage in making these radiating surfaces of such a form as to impede the draught, especially in the case of marine boilers, but would rather choose the form which would give the greatest amount of radiating surface, and offered the least impediment to the free passage of the products of combustion through the tubes. Perhaps as effective a form as any for placing in the tubes of boilers would be a simple straight band of metal, or a wider band bent in the direction of its breadth, at an angle of 60°. In the case of marine boilers, they should be made so as to draw out easily, to enable the tubes to be swept.

BASTIER'S PATENT PUMP.

The following description of an improved chain pump, the invention of M. Bastier, has been sent for publication:—

"The chain pump now employed in the Royal Navy has a calibred tube of uniform diameter, and the discs are furnished with leather washers. Its defects are, namely:—1. The resistance caused by the friction of the leather discs against the inner part of the tubes. 2. The rapid decay and alteration of shape of the leather discs, which cannot retain their elasticity. 3. The loss of the water caused by the spaces left empty by the ascending column of water, and consequently loss of motive power, which renders it unfit for mining or other purposes where the water has to be raised from a considerable depth. In T. O. Bastier's new patented pump-elevator the tube is of unequal diameter, that is to say, some parts at a certain distance from each other are of a slightly smaller diameter than the others. This peculiar disposition proves a great improvement. It replaces the piston, and keeps the column of water suspended by causing each disc passing through the smaller tubes to produce sufficient 'aspiration.' Besides, M. Bastier's discs are furnished with three superposed india-rubber washers of different diameters, which by their permanent elasticity are in continual contact with the inner part of the tubes, and keep them constantly filled. The discs being placed about one yard from each other, it has been found practically that the resistance was sufficiently divided to render the action of the india-rubber washers easy and effective."

The following statements are made as to the advantages of the improved pump:—"1. It utilises from 90 to 92 per cent. of the motive power. 2. Its price and expense of 'installation' are 75 per cent. less than the usual pumps employed for mining purposes. 3. It occupies a very small space. 4. It raises water from any depth with the same facility and economy. 5. It raises with the water, and without the slightest injury to the apparatus, sand, mud, wood, stone, and every object of a smaller diameter than its tube. 6. It is easily removed, and requires no cleaning or attention."

The pump may be seen at Mr. W. P. Warners, Welsh Harp, Edgeware-road (near Cricklewood).

CONCUSSION AND PERCUSSION SHELLS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—In page 96 of Captain Jervis's "Engines of War," he states that "Captain Moorsom, R.N. perfected concussion fuzes." Captain Moorsom's shell was and is a percussion shell. It was I who invented the concussion fuze as far back as 1842, and the select committee of artillery officers at Woolwich were so pleased with its performance that they officially reported that it was "simple, safe, and efficacious, being well adapted for horizontal fire with high velocities." I gave it the name of concussion fuze to distinguish it from all percussion shells of the spherical form, which latter I considered to be highly dangerous, as has since proved to be on more than one occasion. See former numbers of the Mechanics' Magazine.

I am, Gentlemen, yours obediently,

J. Norton.

Rosherville, 24th Oct.

Extract from Colonel Beamish's letter to the Editor of the *United Service Magazine*, August 1859. "It is interesting to trace the progress of human invention, to observe the unaided struggles of genius, the frowns of fortune, the rebuffs of ignorant officials; 'the hope deferred,' the assumption, presumption, and jealousy of rival aspirants, until the name, and fame, and identity of the original are mystified and overlaid by modern pretenders, and the public are left in the pleasing predicament of not knowing 'which is which.'"

RULE TO FACILITATE THE USE OF LOGARITHMS FOR NUMBERS LESS THAN UNITY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—Everybody who has worked much with logarithms knows that the raising of powers or extracting of roots of numbers below unity by their aid is attended with some inconvenience.

This arises from the fact that, in order to facilitate the use of the Tables, it is customary not to take the *real* logarithm of the number, but a certain substituted conventional one. For example, the real logarithm of 0·5 is — 0·301030, but as this number is not found in the tables, it is customary to take the log. of 5, and affix to it a minus index, marking it thus: $\bar{1}$·698970. This is an anomalous kind of expression, one part being positive and another part negative; and, therefore, it is scarcely to be wondered at that its management should cause trouble.

In multiplication or division by logarithms, the rules usually given, though somewhat confusing, are sufficient; but in involution or evolution with complicated exponents they fail; and it becomes necessary to resort to the true method of working, by finding the real logarithm instead of the substituted tabular one, *i.e.*, taking the tabular logarithm of the *reciprocal* of the number, with a negative sign.

I venture, however, to propose a rule by which the substituted tabular numbers may be used, however complicated the exponent of the power or root may be:—

1. Express the exponent of the power or root in the form of a fraction, whose numerator and denominator are both whole numbers.

2. Having found the substituted logarithm from the tables, and given it a negative characteristic in the usual way, make this characteristic *positive*, by adding to it the denominator of the above fraction.

3. Work for the power or root in the usual way.

4. Then subtract from the characteristic the numerator of the before-mentioned fraction, which will bring it negative again, and the result is the substituted logarithm of the answer, which may be found at once by the tables.

This mode, though long in description, is very easy and simple in practice, as the following examples, scarcely practicable at all by the ordinary mode, will show:—

Required the value of $\left(\frac{5}{11}\right)^{\frac{4}{11}}$.

$\frac{5}{11} = 0{\cdot}4555.$

Tabular Log. = $\bar{1}{\cdot}6585411$
Add denominator = 11

$+ 10{\cdot}6585411$
5

$11) 53{\cdot}2927055$

$+ 4{\cdot}8447914$
Subtract numerator + 5

Tabular log. $\bar{1}{\cdot}8447914$

= 0 69956 Answer.

Required the value of $0{\cdot}0000047381^{0{\cdot}0682}$.

Here $0{\cdot}0682 = \frac{682}{10000}$.

Tab. Log. = $\bar{6}{\cdot}6756042$
Add Denom. + 10000·

$+ 9994{\cdot}6756042$
·0682

$+ 681{\cdot}6368762$
Subtract Numerator + 682·

$\bar{1}{\cdot}6368762$

= 0·4333873 Answer.

Required the value of $0{\cdot}5^{2{\cdot}53}$.

Here $2{\cdot}53 = \frac{253}{100}$.

Tab. Log. 0·5 = $\bar{1}{\cdot}698970$
Add Denom. + 100·

$+ 99{\cdot}698970$
2·53

$+ 252{\cdot}238394$
Subtract Numerator + 253·

$\bar{1}{\cdot}238394$

= 0·1731 Answer.

I am, &c.,

W. P.

London, 20th October, 1859.

"HOW BIG BEN SHOULD BE SUSPENDED."

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Gentlemen,—Will you oblige me by inserting in the next number of your Magazine a few words in reply to an article in the last number of the Magazine from Mr. Charles W. Lancaster on the subject, "How Big Ben should be Suspended." The method there mentioned by Mr. Lancaster originated from myself nearly two years since, and was at that time communicated to Mr. C. Mears previous to his casting the present Bell. It also appeared in the Mechanics' Magazine October 7, No. 41, in a letter from Mr. Loseby on Big Ben, and also in the Society of Arts *Journal* of the same date.

I am, Sir, Yours, &c.

Thomas Quarm.

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THE GREAT EASTERN AND STEAM-SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Permit me, in addressing to you a few observations on the formulæ for steam-ship performances, to take the opportunity of adverting first, to an erratum in my last communication, by the omission of part of a sentence, thus rendering it somewhat obscure. I contended therein that in respect to the combination of speed and carrying power, "*the triumph* of the Great Eastern was complete," but the words in italics were omitted. I may add, that her performance was very satisfactory even as to absolute velocity, although it should be admitted that it never exceeded fourteen knots; because as your correspondent "Atlantic" observes, high speed merely was not the paramount object to be achieved, but economic speed, in relation to definite power, and in relation to such power and burthen; with the condition, however, that the absolute velocity should rank with the best steamers of the day. It was on this point of economic speed, in these its two relations, that my communication dwelt; pardon me, therefore, in saying, that your remark about my forgetting "that a very small (comparative) amount of engine power has been given to the Great Eastern," does not apply to my observations, although it certainly is pertinent in respect to absolute speed, and in regard to the lucubrations of those newspaper reporters to whom you allude, and who, it is to be regretted, do not on like occasions hunt in couples, one as the literary and descriptive, and the other as the scientific observer, if the union of such talents in one person is not to be found. It does not apply in my case, because any variation in the magnitude of steam-power embarked in the Great Eastern ought, if within reasonable limits, to give nearly the same constants for dynamic performances.

Now, is the constant 692, as corrected by yourself, anything extraordinary, seeing that four ships of the Royal Navy exceed it! The formula which gives this constant has for its peculiar governing factor, the midship section of the vessel, and indicates the value of its *form*. The result, like that of absolute velocity, is satisfactory, and that is all that can be said. But in regard to the third point—the economic speed in relation to power and burthen—the result is successful in the highest degree, and much more I conceive than the constant 292 indicates, although there is not a vessel in the Royal Navy that approaches it. The appropriate formula in this respect giving the above constant is the usual one—

$$\frac{\text{Velocity}^3 \times \text{Displacement}^{\frac{2}{3}}}{\text{Indicated Horse Power}}.$$

Now, am I mistaken in supposing that this formula, although it may be appropriate for ships of the Royal Navy, does not apply properly to those of the steam mercantile class, and does not do justice to the performance of the Great Eastern in the aspect of commercial excellence, namely, speed in conjunction with great transport capabilities and economic employment of power? It appears to me that this formula does not relate purely to burthen, but mixes up with it the question of section; or rather it infers from the displacement a factitious midship section, instead of the real one, in order that tonnage as well as section should be represented. But surely these two elements should each have its destinctive formula, each excluding the influence of the other, if we would arrive at the merits of a ship in regard to its qualities separately and truly. The square of the cube root of the displacement excludes the influence of the great length in proportion to width for which the Great Eastern is remarkable. It is this, with her great size, and with good lines as a condition, which will give her such pre-eminence in a commercial point of view, and to a degree which no formula within my knowledge sufficiently indicates. Surely what is required is to take the simple displacement as the factor, and not any power thereof. Good lines will no doubt contribute to a good result determined after this manner, but that influence must be ascertained separately, by taking the midship section for the peculiar governing quantity. In this way it is seen that the Great Eastern presents no remarkable result arising out of her form; but at the same time it is seen that the result is so far satisfactory as to permit the other circumstances of her build to have full scope, for a dynamic performance of extraordinary commercial excellence.

May I be permitted to think that the appropriate formula for mercantile steam transport is a subject for the reconsideration of Mr. Atherton and the committee of Section G of the British Association. I am, &c.

BENJ. CHEVERTON.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

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To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number

AN APPEAL

TO THE SUBSCRIBERS AND READERS OF THE "MECHANICS' MAGAZINE."

KNOWING that we have the happiness to embrace among our subscribers and readers a goodly number of large-hearted and charitable persons, we take the liberty (being fully aware that it is a liberty) of bringing to their notice a case of peculiar hardship and distress which calls for something more than the relief which, as individuals, we have been able to afford it.

Early in 1857, a firm well known to the engineering world prosecuted a clerk of theirs for embezzlement, and got passed upon him a sentence of several years' imprisonment—a sentence which, as the judge himself said, was made extraordinarily heavy in proportion to the offence, on account of the prevalence of such offences just at that time. The wife of this man—a refined and excellent person—was left with no less than *seven* children to maintain, not one of whom was then contributing towards its own maintenance. Aided by two of her children she has, since her husband's conviction, laboured with the utmost industry, and to the full extent of her ability, to support her family, and has succeeded with the aid of a few friends in doing this until now, despite a long and dangerous illness. Her health is at last, however, sadly broken down, and unless assisted she will speedily be no longer able to keep her children about her, even should her life be prolonged.

A memorial, praying for a mitigation of the father's punishment, and setting forth in connection with this case other facts to which we need not here refer—(which memorial was signed by the present Lord Mayor of London, the Rev. W. Cadman, M.A., of St. George's, Southwark, — Taylor, M.D., W. Cooper, Barrister-at-law, one of the Editors of this Magazine, and others)—was lately presented to the Home Secretary, but for want of the signatures of the prosecutors was of no effect.

Believing that some of our readers might be willing, or even desirous, to contribute towards the relief and aid of this unhappy person and her family, we adopt this method of making the case known to them. Whatever they may be generous enough to send to ourselves (the Editors of the MECHANICS' MAGAZINE, 166 Fleet Street, London), shall be instantly transmitted to the objects of their benevolence, and duly acknowledged in our advertising columns or otherwise. We need hardly say that the smallest gift would help to gladden the mother's heart. We sincerely hope, therefore, we shall not fail to receive many *immediate* responses to our appeal.

Our Weekly Gossip.

SIR JOSEPH PAXTON proposes that the remains of George Stephenson should be removed to Westminster Abbey. He writes:—"It occurs to me that in honouring the son (Robert Stephenson), the father, who was pre-eminently the author of the locomotive system, ought not to be forgotten, but that his remains should be removed from the comparative obscurity in which they are now placed to Westminster Abbey, and that a suitable monument should be erected there in memory of father and son, to whom England and the world are so much indebted. The removal of the remains of the elder Stephenson was mentioned to me by some of his old associates not very long ago, although without any anticipation of the sad event which appears to make this a proper occasion to bring the matter under public notice. If you, Sir, and the public agree with me in thinking such a step desirable, I am sure the authorities will gladly give their consent to the necessary arrangements; and the friends and admirers of the two Stephensons will not be wanting in their contributions. As a justification for putting myself forward in this matter, I beg to add that I was an intimate friend of the late George Stephenson, and that I also enjoyed the friendship of his son, whom, indeed, a short time before his fatal illness, I had arranged to join in a journey through Egypt next month."

The following letter on this subject has been received:—GENTLEMEN,—I quite agree with Sir Joseph Paxton, who has been honoured by Royal distinction for *minor* services, that the nation's gratitude should speak for itself, in the last tribute paid to the honoured memory of both those illustrious benefactors of their country, the Stephensons. Among the earliest and greatest works of the father George Stephenson, was the union of Liverpool with Manchester in less than one hour by railway and locomotive conveyance, thus largely contributing to make Liverpool the greatest port in the world, and Manchester the greatest town in the world for home and foreign cotton manufactures, besides leading to the formation of all the other railways in this and every other nation. The late Mr. Robert Stephenson stated in his address as President of the Institution of Civil Engineers in 1856 that railway engineers, railway surveyors and railway solicitors, divided between them two millions sterling; and no member of the engineering profession was more extensively and importantly engaged in the execution of these works than the late Robert Stephenson, who with his father, it is said, most deservedly realised nearly half-a-million of money. Among the results of the railway and locomotive system Mr Robert Stephenson states in his address that the whole community in the United Kingdom were then saving (1856) in conveyance alone, forty millions sterling annually; and as this saving had been progressing gradually for twenty years previously, the aggregate amount saved may be computed to be at least two hundred millions sterling. The same patriotic and generous spirit which induced Sir Joseph Paxton to suggest a more appropriate resting-place for the remains of George Stephenson, the father, "as the author of the locomotive system," will no doubt induce the wealthy representatives of George and Robert Stephenson to rescue the remains of another illustrious railway and locomotive benefactor from still greater oblivion than Chesterfield, or the monument so generously and nobly intended at Newcastle-upon-Tyne—the only monument that was erected over the remains of the great man whom I now refer to being the most ordinary tombstone that could be afforded by his widow, scarcely visible and still less legible in the churchyard of Hampstead village—not by removing his dishonoured remains to Westminster Abbey, though very much nearer than Chesterfield, but merely by substituting some humble tablet for the worn-out tombstone erected more than 58 years ago, over the grave. The inscription might be:—"This tablet was erected in 1859 by the representatives of the late George and Robert Stephenson, to the memory of Henry Cort, the founder of the British Iron Trade, and Tubal Cain of our country (See *Times* 29th July, 1859): he departed this life the 23rd May, 1800. Reader, bear in mind this, the humble individual who lies buried here, was robbed of all his property and patent rights by servants of the British Crown in 1783, who were the greatest robbers of the State ever known in English history; yet, without the inventions of this victim to State villany, no railway locomotive, steam engine, or electric telegraph, for manufacture or conveyance, could have been made available either in the old or new world: nor could the consumers of British iron have saved in the price of wrought iron alone, in the last sixty years, six hundred millions of money." SENEX.

We learn from the Paris correspondent of the *Times* that Admiral Paris, C.B., of Brest, has been doing good service in connection with the lifeboat system in France. A very useful pamphlet has just issued from the Paris press, entitled *Instructions sur la Manœuvre des Canots*. It originally appeared in English as *Instructions for the Management of Open Boats in a Heavy Surf and Broken Water, &c.*, and was published under the auspices of the Royal National Lifeboat Institution. The French translation has been very well done by Admiral Paris, and the pamphlet has been extensively circulated on the coasts of France. "I alluded some time since," says the writer just referred to, "to the lamentable want of lifeboats on the French coast, and the offer of the National Lifeboat Association to assist the French Government in this work of humanity. There is not so accurate a Wreck Register and Chart kept here as an

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England, but it is known that hundreds of lives are every year lost from wrecked vessels on the coasts of France. France has an extent of sea-border from Dunkirk to Bayonne of nearly a thousand miles, yet, with the exception of one or two places, there is hardly a single efficient lifeboat on the whole of this extensive and dangerous line of coast, and, as for the mortar and rocket life-preserving apparatus, such things are very little known, perhaps never heard of. Saving human life is as noble a task as destroying it, even for an 'idea,' and the Emperor of the French could not carry out a better one than by ordering some practical and immediate steps to be taken to remedy the evil, and to provide efficient means for saving the lives of thousands of his subjects, and those of other countries, who are shipwrecked on the French coast, and who too frequently perish for the want of such means.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c. *None.*

BOILERS AND THEIR FURNACES, &c., 745.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 740, 759, 793, 794.

SHIPS AND BOATS, including their fittings, 732, 736, 738.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 743, 778, 786.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 753, 758, 764.

FIBROUS FABRICS, including machinery for treating fibres pulp, paper, &c., 739, 751, 771, 774, 776.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 741, 772.

LIGHTING, HEATING, AND VENTILATING, 737, 742, 749, 763, 772, 781, 782.

FURNITURE AND APPAREL, including household utensils, housekeepers, jewellery, musical instruments, &c., 755, 762, 790, 796.

METALS, including apparatus for their manufacture, 744, 752, 775, 777.

CHEMISTRY AND PHOTOGRAPHY. *None.*

ELECTRICAL APPARATUS, 755, 785.

WARFARE, 731, 757.

LETTER PRESS PRINTING &c. *None.*

MISCELLANEOUS, 733, 734, 735, 746, 747, 748, 750, 754, 760, 761, 765, 766, 767, 768, 769, 770, 773, 779, 780, 783, 788, 791, 795.

731. R. A. BROOMAN. "Improvements in fire-arms and ordnance, and in projectiles and apparatuses to be employed therewith." (A communication.) Dated March 22, 1859.

The patentee claims, 1, the construction of breech-loading arms described with reference to the drawings. 2. The use of a cartridge with a preliminary priming which is discharged by a pin or needle fitted in a hole of two different diameters. 3. The forming of a bullet to answer the purpose of an ordinary bullet and cartridge. 4. The application of the foregoing improvements in small arms to revolving fire-arms. 5. The construction of breech-loading cannons, described with reference to the drawings. 6. The construction of a non-recoil carriage for cannons, described with reference to the drawings. 7. The forming of projectiles for rifled small arms or cannons with wooden projecting plugs, either let partially into, or passing entirely through the projectile. 8. The construction of a rod with spring arms for cleaning out the bore and grooves of breech-loading cannon, all as described with reference to the drawings. *Patent completed.*

732. J. TYSSEN. "An improved apparatus for indicating the speed of ships and other vessels." Dated March 22, 1859.

This consists of an apparatus to be fitted to a ship to show inboard the speed at which the ship is passing through the water. The inventor fits on the axis of a three-bladed screw, which is placed outside the vessel, a wheel inboard, which wheel gears into one or more wheels, and causes the last in a train to make say one revolution when the vessel is progressing at say ten knots an hour, which revolution is shown upon an indicating dial. *Patent completed.*

733. C. A. WATKINS. "Improvements in the manufacture of brushes." Dated March 22, 1859.

The patentee claims, 1, a method of securing hair in circular and oval brushes by means of certain metal bindings. 2. The manufacture of socket brushes and sockets for brushes with a binding formed of wire rods or strips of metal, such binding being employed as the socket itself or to form only part of the socket. 3. The holding of the binding for brushes together while being formed, and the binding after being formed, to the block or cap by strips of metal. 4. The use of a pin for securing the block of socket brushes to the handle. 5. The securing of wire bound brushes generally by soldering the wires together after the brushes are made—all as described with reference to the drawings. *Patent completed.*

734. J. MACINTOSH and G. RHODES. "Improvements in tents and such like coverings for shelter against the weather." Dated March 22, 1859.

This invention has been described and illustrated in the MECHANICS' MAGAZINE. See pages 201 and 220, Vol. 1 (New Series). *Patent completed.*

735. S. ORAM. "Improvements in pipes or tubes for generating and superheating steam." Dated March 23, 1859.

The improved pipes are made of spiral, corrugated, undulated, or indented forms to give increased heating surface. *Patent completed.*

736. W. ADAMSON. "Improvements in apparatus for propelling vessels." Dated March 23, 1859.

This is applicable to vessels of light draught. The patentee places on the under side of the vessel a flap which turns at one of its ends on an axis parallel with the keel. This flap works water tight within a chamber of a suitable form to permit it to make a partial revolution on its axis. The chamber is open at its after end, and in the sides of the chamber there are valves which alternately open and permit water to flow into the chamber when the flap is moved away from the side in which they are situated, and close when the flap is moved towards them, the water being thus forced out at the open end of the chamber, by which means the vessel is propelled forward. *Patent completed.*

737. S. CLARKE. "Improvements in the manufacture of candles." Dated March 23, 1859.

This consists in manufacturing candles with their lower ends composed of plaster of Paris or other cement, which, in addition to extending the lengths of the candles, also sustains the wicks whilst the lower portions of the candles are being consumed. *Patent abandoned.*

738. W. MIDDLESHIP. "Improvements in propelling vessels." Dated March 23, 1859.

Here the screw is to be made hollow, or open at the centre, so that its interior space may communicate with the interior of a hollow shaft on which the screw is mounted. Water is to be admitted to the central hollow shaft, and allowed to flow to the ends of the arms, blades, or plates of which the screw is composed. The water will be discharged obliquely at the periphery of the screw, and if desired it may be arranged to deliver the water from suitable openings at either side of the blades. The reactionary force of the effluent water rushing from the openings in the blades will cause the screw to rotate. *Patent completed.*

739. J. EVANS. "Improvements in the manufacture of paper." Dated March 23, 1859.

Here the paper is burnished by bringing it into contact with one or more polished rolls, driven rapidly as compared with the surface speed of the paper, the paper being supported by other hard and polished rolls. *Patent completed.*

740. B. BROWNE. "A new method of working or operating switches and signals on railways by improved apparatus for such purpose." (A communication.) Dated March 23, 1859.

This consists in working switches and disc signals by causing the flanges of the running wheels of the carriages and levers connected to the engine to actuate mechanism fixed at certain parts of a line of railway. The mechanism consists of a hydro-pneumatic swing table, connected with which are pumps in which oil is placed. An important feature in this invention consists in employing oils of a non-siccative character, or not capable of congealing in cold weather. *Patent completed.*

741. J. V. HIELAKKER. "Improved apparatus for pressing or moulding artificial or patent fuel, fire-bricks, and similar articles." Dated March 23, 1859.

This consists of certain new mechanical arrangements constituting an apparatus in which percussion force is to be employed for effecting compression of the materials to be moulded. *Patent abandoned.*

742. G. NEAL. "Certain improvements in apparatus or fittings connected with the burning of gas for regulating and economizing its consumption." Dated March 23, 1859.

In this description of regulator the chamber or cavity containing the principle of regulation forms the base of the part that extends up, surrounding the base of the burner. This cavity the inventor fills with sponge or other like porous homogeneous matter, in a bulk, or in separate layers, so arranged that by a perforated plate, or by wire gauze discs suitably strengthened, he is enabled to compress such porous matter so as to regulate or allow the gas to penetrate through it at such a rate that when lit it shall be enabled to commingle with and consume a due proportion of atmospheric air to produce silent and perfect combustion in the burning of gas, and consequent purity and brilliancy of light. *Patent completed.*

743. W. DELANY. "Improvements in ploughs for tilling land." Dated March 23, 1859.

This consists in the use of a number of wheels fixed upon stationary horizontal axles carried in a rectangular frame. A cam groove is formed in the periphery of each wheel, which groove is in a plane at right angles to the axle, excepting at one part where it is made to diverge slightly out of its course, and to return to it again. These wheels are each enclosed by a pair of discs formed with flanges at their peripheries, and rotating loosely upon the axles, the flanges surrounding and enclosing the wheels. These discs carry at their peripheries a series of cutters or knife-edged plates which radiate from the axles, and revolve with the disc so as to cut the surface of the soil into strips, and then to turn such strips over after the manner of the ordinary mould board of the plough. *Patent abandoned.*

744. J. H. JOHNSON. "Improvements in machinery or apparatus for the manufacture of sheet tin." (A communication.) Dated March 24, 1859.

This consists in attaching the vessels into which the melted tin is poured to endless bands or chains which have a continuous travelling motion imparted to them. Elastic bars are so arranged as to moderate the pressure of the vessels against the spreading plate or surface during their passage over or along such surface. *Patent completed.*

745. P. P. BOLL and H. REGER. "Improvements in steam boiler and other furnaces." (A communication.) Dated March 23, 1859.

This consists in constructing furnaces with two or more fire-places in combination with suitable flues, so arranged that the gases distilled from the fuel fed upon the fire bars of one fire-place shall be caused after traversing the furnace to enter beneath the fire-bars of another fire-place and pass up through the hot fuel upon them, being thus effectually consumed. *Patent completed.*

746. F. TILLETT. "Improvements in machinery for cutting splints for matches." Dated March 23, 1859.

This consists in combining a set of reciprocating lances or cutters (for grooving the block to be cut into splints) with a knife or cutter for slicing off the grooved portions, so that the cut of the slicing knife shall take place at right angles, or nearly so, to the cut of the grooving instruments. *Patent completed.*

747. W. and J. GARFORTH. "A certain improvement in metallic pistons." Dated March 24, 1859.

This consists of an outer ring or rings of ordinary construction which are to be expanded against the cylinder by an internal V-ring made in sections, each of which sections being provided with a small piston or pistons, one end of which acts upon the ring, and the other receives the direct pressure of steam which is supplied and conveyed to an angular space in the interior of the piston by a steam pipe which rises and descends through a stuffing box in the cylinder cover with the action of the piston. *Patent completed.*

748. W. E. WILEY. "Improvements in the manufacture of boxes or cases used for holding needles, pens, matches, pencils, and for other like purposes." Dated March 24, 1859.

This invention embraces various modifications, and is not fully described apart from the drawings. *Patent completed.*

749. W. E. WILEY. "New or improved instruments to be used in burning and supporting candles." Dated March 24, 1859.

This consists principally of a cap, or a tube terminated by a cap, which cap or tube is placed upon the candle while burning. The wick of the candle protrudes through a hole in the summit of the cap or tube, and the said cap or tube, resting on the top of the candle, descends as the candle burns. *Patent abandoned.*

750. F. E. SHARP. "Improvements in machinery for corking bottles." Dated March 24, 1859.

This consists in the use of a table moving on a centre axis, in connection with which are certain wheels and levers, which upon being actuated either by steam or other power effects the working of the bottles. *Patent completed*

751. E. S. TEBBUTT. "Improvements in the

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manufacture of elastic fabrics." Dated March 24, 1859.

The inventor cements in the ordinary way the inner surfaces of the fabrics which are to be united to form the compound elastic fabric, and inserts between them bands or tapes of india-rubber, the tapes being at tension at the time of the joining of the fabrics in order to produce the puckering or corrugations. *Patent abandoned.*

752. C. SANDERSON. "Improvements in preparing, tempering, and covering or coating thin strips or sheets of steel." Dated March 24, 1859.

One of these improvements consists in hardening the strip or sheet of steel when in the full or normal size, as it comes from the cold rolls, and before it is cut up into the narrow strips which constitute crinoline steel. The strip or sheet is coiled round so that a small space is left between each coil. This is effected by coiling along with the strip of steel a piece of wire of a thickness corresponding to the distance required between the coil of the sheet. When the sheet of steel is coiled in this manner the oil in which it will be plunged to harden it will circulate over the whole surface of the strip. After removal from the muffle in which it has been treated a spindle is passed through the centre of the coil, and the strip of steel being removed therefrom is gradually passed between a pair of metal dics which are kept at a red heat. *Patent completed.*

753. W. CLARK. "A machine for separating oats from their husks or chaff." (A communication.) Dated March 24, 1859.

This invention is not described apart from the drawings. *Patent completed.*

754. H. RIGBY. "Improvements in machinery or apparatus for obtaining motive power, applicable to hoists, and all other purposes to which motive power can be applied." Dated March 25, 1859.

The patentee employs an upper reservoir of water, and by a regulating valve allows the water to fall upon the buckets of a water-wheel or turbine, the water being delivered into a similar reservoir below. The water-wheel or turbine gives motion to a series of hydraulic pumps for forcing the water into one or more hydraulic rams, to each of which a larger pump bucket is attached, working in a suitable barrel, the bottom of which is placed in the lower reservoir. As the turbine turns from the supply of water, and gives motion to the series of pumps, the ram or rams rise and raise the larger bucket or buckets, the effect of which is to raise the surplus water from the lower reservoir to the upper. *Patent completed.*

755. C. COWPER. "Improvements in telegraphic cables." (A communication.) Dated March 25, 1859.

Here copper wire is first covered with a coating of gutta-percha, &c., and then with a mixture composed of caoutchouc, gum lac, tar, and cork reduced to powder, in such proportions that the cable shall be but slightly heavier than the water. *Patent abandoned.*

756. R. BAKER. "Improvements in chronometers, watches, and other time-keepers." Dated March 25, 1859.

This consists in constructing the escapement of chronometers, watches, &c., with a balanced detent lever carrying a pin which enters a groove in a piece or block carried by the balance, except at the point where the impulse is to be given. *Patent completed.*

757. J. H. JOHNSON. "Improvements in fire-arms." (A communication.) Dated March 25, 1859.

This relates more particularly to that class of self-primers wherein the magazine is contained in the hammer of the lock. It is proposed to combine suitable mechanical devices with the slide which pushes forward the individual primers (which are of the flat or wafer kind) into the striking part of the hammer, by which combination the slide can be kept rigidly in position over the mouth of the magazine chamber, so as to intercept all communication with the latter. *Patent completed.*

758. W. E. NEWTON. "Improvements in ovens for baking bread and other substances." (A communication.) Dated March 25, 1859.

This relates to an arrangement of parts whereby the oven is rendered automatic, and consists in a system of screws and endless chains in combination with a system of permanent ways or tracks leading from end to end of the interior, and through the doorways of a horizontal oven. The invention is not fully described apart from the drawings. *Patent completed.*

759. C. HILL. "Improvements in the permanent way of railways." Dated March 25, 1859.

When supporting the rails by side bearing plates having flanges on one or both sides, the inventor forms the rail with a web or keel which projects downwards below the bearing plates, strengthening the rail itself, and preventing it and the bearing plates from moving sideways; the lower end of this web or keel may be formed with a flange or rest projecting on each of its sides. There are various modifications included. *Patent abandoned.*

760. H. HUMPHREYS, Sen. "An improvement in unhairing hides and skins, and in the manufacture of leather." Dated March 25, 1859.

This consists in the application of the ashes of spent tanners' bark in the unhairing process. The spent tanners' bark is burnt to an ash, the ash combined with water, and is then used. *Patent abandoned.*

761. G. HASELTINE. "Improvements in the manufacture of small metallic chains." (A communication.) Dated March 26, 1859.

This relates to the construction of a chain composed of domed or cup-shaped links, the several operations being performed by certain novel mechanical devices. The invention is not described apart from the drawings. *Patent completed.*

762. W. REDGRAVE. "An improved pillow travelling cap." Dated March 26, 1859.

The inventor describes a tube of air-tight material. *Patent abandoned.*

763. E. STEANE. "An improved means or apparatus for preventing candles dropping or guttering." Dated March 26, 1859.

This consists in a protecting hood, cap, or cover, to fit over the top of the candle, descending as the candle burns away. *Patent completed.*

764. S. DREYFOUS, G. RICHER, and E. CORNIER. "Improvements in preserving eggs." Dated March 26, 1859.

This consists in introducing the eggs into boxes moulded of plaster of Paris, and hermetrically sealing the boxes, the eggs being wrapped in paper and surrounded with charcoal powder. *Patent abandoned.*

765. M. FIRTH. "Improvements in machinery for grinding saws and flat plates of steel." (A communication.) Dated March 26, 1859.

Here the patentee arranges beneath a grinding stone an adjustable table, supported at one end by a short shaft forming a hinge, which rests on a casting or pan. To this casting or pan set screws are fixed for regulating the table that it may grind the saws thinner on the back if required. The other end of the table rests on a screw attached to a wheel, by which the table can be raised to the face of the grinding stone, or withdrawn from it at pleasure. On top of the said table he places a carriage on which the saw to be ground is placed, and is made to travel backwards and forwards in a direction transverse to the axis of the stone, or nearly so. To prevent the saw from coming off the carriage while in the process of grinding he affixes a plate of metal at one end of the carriage, of nearly the same thickness as the saw to be ground. One end of the saw coming against the said plate prevents it from coming off the carriage while grinding. He also places a cover over the saw to prevent it from spinning off the carriage. The table and carriage rest in a wooden frame, to which are attached two standards for supporting the brackets in which the shaft supporting the grinding stone revolves. *Patent completed.*

766. G. NAYLOR. "An apparatus for measuring and indicating the distance passed over or travelled by the same." Dated March 26, 1859.

This consists in the combination of a graduated "motive or running wheel," a "toothed wheel moving in trundle gear," a dial-plate, and a hand or pointer. *Patent abandoned.*

767. J. C. EVANS and P. SOAMES. "Improvements in apparatus for superheating steam." Dated March 26, 1859.

This consists, 1, in the use of a set of superheating pipes in front of the tube-plate. 2 In the employment of a superheating chamber, heated by a separate fire. 3. In the use of superheated pipes, heated by a highly heated fluid, or by molten metal. 4. In the general arrangement of apparatus, shown in drawings. *Patent completed.*

768. M. A. MUIR and J. MCILWHAM. "Improvements in moulding or shaping metals." Dated March 26, 1859.

This relates to a system of mechanically moulding various moderately-sized articles in metal, but in particular railway chairs. The mechanical arrangements consist essentially of two separate divisions, viz., that relating to the ramming of the moulding sand upon the pattern, and that comprising the removal of the pattern from the moulded sand, or the "drawing" of the pattern. We cannot quote the details of the invention here at sufficient length for an intelligible abstract. *Patent completed.*

769. E. DOWLING. "Improvements in weights." Dated March 26, 1859.

Here the inventor forms glass weights of any suitable shape, but for the large ones he prefers them circular with a double bulge and flat at the bottom, the larger bulge serving as the base, and the smaller one to take hold of. He forms a hole through the body of the glass from top to bottom, such hole being largest at the ends and small in the middle. Thus a cylindrical piece of lead or other soft metal may be inserted and pressure applied above and below, which will fix the lead or soft metal firmly in the glass. *Patent abandoned.*

770. B. and C. L. SMITH. "Improvements in the preparation of certain colouring matter, applicable for dyeing and printing." Dated March 26, 1859.

This consists in precipitating the colouring matter from ordinary archil liquors of commerce, so as to obtain from them the colouring matter in a concentrated or solid form. *Patent completed.*

771. J. BUCKLEY, O. GREENHALGH, and R. HUTCHINSON. "Improvements in machinery or apparatus for printing woven fabrics." Dated March 26, 1859.

This consists of an apparatus for printing both sides of a fabric at once. It is not described apart from the drawings *Patent completed.*

772. C. J. RICHARDSON. "Improvements in apparatus to be applied to chimneys or flues of buildings, for preventing down draught or return smoke, for their insuring upward ventilation, and for reducing the quantity of smoke or the blacks from the smoke passing into the atmosphere." Dated March 28, 1859.

This consists in a contrivance for the prevention of down draught, called the "wind cap," in a contrivance for securing ventilation called the "iron stack flue," and in a contrivance for reducing the quantity of dense smoke or blacks passing into the atmosphere called the "rain vase." We cannot devote space to the details of the invention. *Patent completed.*

773. C. F. VASSEROT. "An improved diving apparatus." (A communication.) Dated March 28, 1859.

This consists of a garment formed of metallic framework, the joints of which are covered with a waterproof coating. By means of this garment a body sunk at the bottom of the sea may be visited, and chains fixed to for raising it. Each chain enters an iron tube which passes at different inclinations through a large cylinder of sheet iron, and the upper part of each tube is furnished with a check for holding the chain when it is drawn up. This cylinder is connected by caoutchouc pipes with an air pump, and has valves for the admission and effluxion of water. *Patent abandoned.*

774. J. BUCKINGHAM. "Improvements in machinery or apparatus employed in drawing fibrous substances." Dated March 28, 1859.

This consists in the application to the surface of the leather coverings of covered rollers of "a varnish or solution of gutta-percha, or other similar gum, non-soluble in oil, dissolved in any suitable solvent. *Patent completed.*

775. A. V. NEWTON. "An improved construction of furnace for reheating steel, preparatory to the hardening, tempering, or annealing process." (A communication.) Dated March 28, 1859.

This consists in so arranging the furnace as to cause the flame and heat to act upon a closed oven or chamber in which the metal to be operated upon is placed, so as to distribute the heat under, above, and in the back of the oven or chamber, and to communicate a powerful and steady heat to the interior of the oven or chambers, while such interior and its contents have no communication with the flame or gases of combustion, and as little as possible with the external atmosphere. *Patent abandoned.*

776. A. TURNER. "Improvements in the manufacture of elastic fabrics." Dated March 28, 1859.

This consists in the use of threads or yarns composed of wool in combination with some other fibrous material, such as silk, cotton, flax, &c. These compound threads are chiefly intended to be used as warp threads. Strands of india-rubber may be combined with the above. *Patent abandoned.*

777. A. V. NEWTON. "Improved apparatus for retaining the oil or other fluid used for annealing, tempering, and hardening steel at any equable low temperature." (A communication.) Dated March 28, 1859.

The apparatus here employed consists of two large iron cylindrical tanks placed side by side at a short distance from each other in a timber framing. The tanks are connected by a pipe near the bottom to allow the fluid to run freely from one vessel to the other. Within each tank is a worm or coil of metal pipe through which water circulates to keep the oil cool. A space is left in the centre of the coil in one of the tanks for a well in which the springs or metal may be plunged and withdrawn without interfering with the coils. These tanks have moveable covers perforated with small holes, and the cover of the immersion tank has a circular opening at the centre, large enough to

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admit the springs or pieces of steel with facility. The small holes in the cover act as strainers for the oil from the springs, &c., placed upon them. Over and upon the central part of the other tank there is a metallic cylindrical chamber which contains a central tube and a series of horizontal perforated discs. In connection with this chamber is a pumping apparatus whereby the heated oil is drawn from the immersion tank through a suitable pipe and delivered into the perforated discs of the upper chamber from which it descends in a shower, and is cooled by currents of air. The cooled oil runs through the perforated cover of the tank below into the said tank and from thence into the immersion tank. *Patent abandoned.*

778. T. CARR. "Improvements in machinery for disintegrating artificial manures, and various other substances." Dated March 29, 1859.

This consists of a series of circular cages, arranged on an axis concentrically, the outer periphery of each cage being composed of bars having open spaces between them. The material is placed in the central cage, and it is by centrifugal force thrown through the bars of the several cages. The cages move in contrary directions. *Patent completed.*

779. C. L. ROBERTS. "Improvements in cigars." Dated March 29, 1859.

This consists in enclosing within the ends of cigars month-pieces of glass, earthenware, wood, &c., having inner tubes or linings of straw, and so placed as to admit of one end being held within the mouth whilst the other is embedded in the cigar. *Patent completed.*

780. W. MOSSMAN. "Improvements in machinery applied to embossing or cutting presses, for the better and more expeditious manner of manufacturing ornamental, cut out and embossed work in paper, leather, parchment, cloth, foil and other materials." Dated March 29, 1859.

This consists in affixing a plate or block to the dab of the embossing or cutting press, or placing between the dab and the die a plate or block of metal adapted so as to press or bear equally on all the cutting edges of the die or dies. Also using in the manufacture of such ornamental work thin plates of metal, especially zinc, for the cutting edges of the dies to press against; also for the sliding framework and moveable point or points, to the lid or cover for the paper or other substances when cut remaining in the die until embossed. *Patent completed.*

781. J. W. KELLY. "Improvements in gas-burners." Dated March 29, 1859.

This consists, 1, in the application of a small cylindrical tube or ring of brass or other metal to the outside or top of the burner, whereby a more complete combustion of the gas is obtained. 2. In making a small number of apertures immediately above or on the burner side of the cock, which apertures are to be of various sizes, and in covering or enclosing these apertures in a small bell-shaped or other form of chamber, at the top of which is to be inserted a burner of larger apertures than any of those enclosed beneath. By this means, and with the aid of an external index or dial, the key of the cock may be turned so as to lead to the gas through any of the apertures mentioned, and thus let pass to the burner a quantity of gas corresponding exactly to that which would be issued by any one of the burners now in use. *Patent completed.*

782. E. DE CARANZA. "A new system of gas lighting through new apparatuses and matters richer in gas than pit-coal." Dated March 29, 1859.

Here the inventor obtains gas from boghead or compile clay, greasy sawdust obtained from wood that has been used in refining or cleansing fatty matters, pit-coal, and the fatty residues left in the extraction of schistic oils. The invention comprises an arrangement of cylinders, retorts, and furnaces, specially applicable for use in private establishments. *Patent abandoned.*

783. E. N. NORMINTON. "The cleansing and re-manufacturing of old used dirty railway grease for the manufacturing of new railway grease, for the cleansing and re-manufacturing of old used cotton waste, tow, or any other textile fabric, and for the purifying of oils, or any fatty matter." Dated March 29, 1859.

This consists in the combination of carbonate of soda, sulphate of soda, or sulphuric acid, with palm oil, or other fatty matter for the manufacture of railway grease. It also comprises various operations for effecting the objects indicated in the title. *Patent abandoned.*

784. T. W. MEEKINS. "The production of a motive power and of a projectile and explosive force to be used in instruments of war." Dated March 29, 1859.

The object here is the evolution of gases in the same, or in separate vessels, by electricity, or by other means, and the invention consists in their introduction into a cylinder in a mixed or separate state, to be there combined by an electric spark, or by other means. The invention is applicable to various purposes. Provisional protection was not granted for this invention.

785. R. SEARLE. "Improvements in apparatus used for transmitting signals by electricity for telegraphic purposes, and in the construction of telegraphic cables." Dated March 29, 1859.

The patentee claims, 1, the mode of manufacturing telegraphic cables with a core centre or foundation formed of bamboo or rattan canes spliced together so as to form a support of the required length. 2. Placing the wire band or ribbon in a spiral form round or upon the core or support, by which means the patentee removes the tension or strain of the cable from the conducting medium. 3. Increasing the surface of the metallic conducting medium by forming it into three bands or ribbons, or grooved or corrugated wires. *Patent completed.*

786. I. SPIGHT. "Improvements in horse-hoes." Dated March 29, 1859.

Here the hoes are attached to levers connected with a revolving shaft near the front of the machine. This revolving shaft works in bearings in a slide frame, and is moved by turning a handle attached to a shaft working a rack or worm thread, by means of which all the hoes work on the same level. One end of each of the levers, to which the hoes or hoe shanks are attached, being fixed to this revolving shaft by sockets or otherwise, instead of hanging loosely as heretofore, the hoes will all cut level, and not be liable to clip on one side. The depth to which the hoes penetrate the ground is regulated by the height of the revolving shaft in the slide frame. At the top of each of the hoe shanks is a socket which slides upon the lever connected with the revolving shaft, and which may be fixed in any position required for different kinds of corn or roots by set screws, clasps, or otherwise. *Patent completed.*

787. T. TAYLOR. "Improved means of giving increased strength to paper." Dated March 29, 1859.

This consists in soaking paper when dry in a concentrated neutral or nearly neutral solution of chloride of zinc, either at the natural temperature of the air, or moderately heated, and afterwards thoroughly washing the paper in water. *Patent completed.*

788. H. P. BURT. "Improvements in apparatus for preparing and preserving timber." Dated March 29, 1859.

This relates to apparatus for impregnating railway sleepers and other timber with creosote or other preservative liquids or solutions, which apparatus may also be used for impregnating timber with liquids or solutions for clearing the wood, or for rendering it incombustible. *Patent completed.*

789. H. MOSS and T. WEST. "A machine for the cutting of leather for every purpose, and cutting cloths, linen, and other fabrics and materials." Dated March 29, 1859.

This relates to regulating the feed, and consists in the use of a self-acting table, on which, by means of a cam motion, is worked a knife, constructed so as to cut a square edge; the machine may be worked with or without a self-acting feed. The knife is so constructed, from its being larger at the top than at the bottom, that when applied without the self-acting feed it may be discharged from the top, so that it gives a facility for cutting some six or seven shapes before it requires emptying; it is also so constructed that when the self-acting feed is applied by the application of springs, it leaves the material which is being cut quite clear of the knife or stamp. *Patent completed.*

790. W. BROWN. "Improvements in manufacturing clog soles, and in the machinery employed therein." Dated March 30, 1859.

This consists in the use of certain cutters having a rotary or reciprocating motion given to them by steam, or other power. *Patent completed.*

791. J. H. LINSEY. "Certain improvements in binding or covering books." Dated March 30, 1859.

This consists in fixing to the back of the leaves of the book a strong cloth or leather hinge, as is usually employed, which is secured to the cover by plates of metal, one of which is fixed to each cover; two other metal plates clip or confine the loose sides or flaps of the hinge between them, so that a new set of leaves may be securely fixed without injury to the book or covers. *Patent abandoned.*

792. J. W. HADWEN. "A new art or manufacture for converting certain kinds of silk waste into yarns or threads." Dated March 30, 1859.

The patentee claims the combination of the several processes of dressing, drawing, doubling, roving, and spinning applied in the manner set forth to the manufacture of yarns or threads from uncut and long fibred soft silk waste, and also the combination of the several processes of drawing, doubling, woving, and spinning, applied as described to the manufacture of yarns or threads from uncut and long fibred soft silk, after the said waste has been dressed, combed out, cleared, &c., &c. *Patent completed.*

793. W. V. EDWARDS. "Improvements in the construction of ways and apparatus to facilitate the conveyance of mails, goods, and passengers. Dated March 30, 1859.

Here a tunnel or enclosed passage is constructed between distant places. At the lower part of such tunnel two parallel trams or rails are formed in longitudinal grooves or recesses. Arrangements are made for a train of carriages to be brought to rest by means of valves which are caused to descend and close a given section or length of the tunnel, and passages are opened to admit air into such closed sections, in order that there may be no pressure of air acting on the carriages in one direction, whilst the tunnel is exhausted in advance of the carriages. A piston is applied in advance of or behind the train, and the tunnel is kept exhausted in advance of the carriages when they are required to be in motion. *Patent abandoned.*

794. G. T. BOUSFIELD. "Improvements in preventing explosions in steam boilers." (A communication.) Dated March 30, 1859.

This consists in the application to various kinds of engines, of an apparatus for stopping entirely or partially the flow of steam, &c., to the engine when the pressure becomes too high, and by this means to stop or retard the engine. *Patent abandoned.*

795. T. D. SHIPMAN. "Improvements in apparatus for stamping and printing." (Partly a communication.) Dated March 30, 1859.

Here the printing surface is fixed in a suitable frame, which is affixed to and slides with an upright bar or rod, which moves in suitable guides. The rod or bar is attached to one end of a lever, and the other end of the lever is constantly drawn downwards by a suitable spring, so as to raise the printing surface when allowed to do so. An inking roller is carried by the forked end of a lever which has its axis or fulcrum above the lever before mentioned. The other or back end of the forked lever is constantly drawn on by a suitable spring, so as to cause the inking roller to pass under the printing surface. The back end of the forked lever is attached by a link or connecting rod to the fore part of the lever, which acts on the printing surface, by which the movement of the forked lever is caused to depend on the movement of the other lever; by this means at each movement an impression is produced. There are also arrangements in connection with the inking process. Under the printing surface there is an elastic bed of vulcanized india-rubber. *Patent completed.*

796. H. JEFFERIES. "Improvements in castors for furniture." Dated March 30, 1859.

Here, in making a castor of that description where a sphere is used as the roller, the frame or body of the castor is made of one piece of glass, china or earthenware, with a recess at its under side to receive the spherical roller. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Aug. 30, 1859.

1973. T. Eastman. Improvements in screw propellers. (A communication.)

Dated Oct. 1, 1859.

2225. S. Ward. An apparatus to be used in the hardening of saws and steel plates generally.

2227. C. Brown. Improvements in inkstands and date indicator.

Dated Oct. 4, 1859.

2249. J. Rawlings. An improved construction of boot-tree.

Dated Oct. 6, 1859.

2271. G. A. Smith. Improvements in shot and shells, and other projectiles.

2273. W. Hopkins. A new or improved steam engine.

2275. G. Freeman and J. Royle. Improvements in looms.

2277. W. Macfarlane. Improvements in machinery or apparatus for drawing off or discharging liquids, and in fountains, baths, and similar receptacles for liquids.

2279. W. Benson. Improvements in projectiles for muzzle-loading rifled ordnance.

2281. W. Barron. Improvements in boilers applicable to heating and steam generating purposes.

2283. W. E. Newton. Improvements in the construction and manufacture of casks, barrels, and such like vessels, and in the machinery or apparatus to be employed for such manufacture. (A communication.)

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Dated Oct. 7, 1859.

2285. G. L. Lee. Improvements in producing printing surfaces.

2287. G. P. Dodge. Improvements in apparatus for preserving life, applicable to garments. (A communication.)

2289. D. McCallum. Improvements in electric telegraphs.

Dated Oct. 8, 1859.

2291. W. Irlam. Improvements in the construction of railway turntables and cranes.

2293. J. Brough. An improved waterproof dress for protecting and saving life at sea or in any other situations where a waterproof dress may be required, as also in the apparatus to be attached to or used with the same, for assisting the wearer to hoist or make signals, by night or by day, and to inflate, propel, and guide or direct himself as desired, the waterproofing principle of which being also applicable to other useful purposes.

2295. J. Childs. Improvements in the manufacture of artificial gums.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Oct. 25, 1859.*)

1414. W. Donbavand and D. Crichton. Looms.
1424. O. Maggs. Washing machines.
1426. C. N. Kottula. Purifying the Thames.
1433. J. Cowan. Soap.
1452. H. F. Smith. Driving straps.
1457. T. Orrell, jun. Mules for spinning.
1459. E. T. Hughes. Treating fatty substances. (A communication.)
1465. A. V. Newton. Assorting substances of different specific gravities. (A communication.)
1468. J. Cox. Cutting rags.
1469. A. Jeffery. Projectiles.
1471. R. Harper, R. Stokes, and T. Walker. Bonnet wreaths and feathers.
1473. G. J. Parker. Giving alarm of fire.
1475. P. F. Aerts. Lubricating.
1481. C. L. J. Dierickx. Coining.
1485. W. Rowan. Generating steam.
1496. E. Oliver. Medicine for rheumatism, &c.
1598. J. Apperly and W. Clissold. Wheels.
1507. M. A. F. Mennons. Bolts and rivets. (A communication.)
1532. R. Dick. Addressing cards, &c.
1539. W. E. Newton. Steam engines. (A communication.)
1559. T. Bell. Manure.
1573. S. Fisher. Ordnance and projectiles.
1604. C. Hagan. Curing smoky chimneys.
1652. J. Luis. Railway car seats and armchairs. (A communication.)
2103. H. Winter. Lifting and weighing.
2122. T. Elliott. Lubricators.
2133. R. A. Brooman. Elevators or lifts. (A communication.)
2170. T. B. Daft. Coating conductors.
2172. J. Todd. Screw propellers.
2190. W. Collins. Hydrants.
2202. C. Stevens. Steam-dredging boat. (A communication.)
2217. B. Atkinson. Railway brakes.
2267. J. Macintosh. Flexible tubes.
2269. J. Macintosh. Coating conductors for telegraphs.
2277. W. Macfarlane. Drawing off liquids.
2283. W. E. Newton. Casks, &c. (A communication.)
2331. T. Twells. Embroidering.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Oct. 19, 1859.

994. J. M. J. and E. Johnson.
1002. J. Napier.
1005. D. Auld.
1007. E. Lewthwaite and G. Ambler.
1010. T. S. Truss.
1018. J. Angus.
1025. J. Marshall.
1040. J. Higgin.
1044. W. Mackenzie.
1048. R. A. Brooman.
1055. H. R. Fanshawe.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2442. R. H. Collyer.
2462. H. Deacon.
2474. G. Thomson.
2470. W. E. Newton.
2480. G. Ermen.
2504. L. A. Mangin.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

450. G. Heyes.
494. J. Gilbert and S. Nye.
655. R. B. Cousens.
725. J. F. Belleville.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Oct. 21, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
650	0 10	671	1 4	687	0 3	703	0 3	721	0 9	742	0 3
651	0 8	672	0 6	688	0 3	705	0 7	722	1 3	744	0 6
652	0 10	673	0 7	689	0 3	705	0 6	723	0 3	745	0 9
653	0 6	674	0 3	691	0 4	706	0 6	724	0 7	749	0 3
654	0 10	675	0 3	692	0 10	707	0 3	725	0 11	751	0 3
655	1 4	676	0 3	693	0 5	711	0 3	726	0 10	752	0 3
657	0 11	677	0 3	695	0 3	712	0 6	730	0 3	755	0 6
658	0 3	678	0 6	696	0 7	715	0 3	731	0 8	757	0 7
660	0 7	679	0 6	697	0 3	714	0 3	732	0 9	758	0 7
662	0 10	680	0 6	698	0 3	715	0 3	734	0 4	760	0 3
664	0 9	681	0 3	699	0 3	716	0 3	735	0 6	764	0 3
665	0 6	683	0 3	700	0 5	717	0 3	730	0 6	765	0 7
666	0 5	684	0 6	701	0 3	718	0 3	737	0 3	769	0 3
667	0 6	685	0 3	702	1 9	719	1 3	738	0 10	770	0 3
668	0 7	686	0 3	703	0 4	720	0 3	742	0 7	778	0 10
670	0 7										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
Oct. 3,	4202	Williams & Bate, Birmingham	Case.
,, 5,	4203	T. Ridge, Hackney	Upper for boots.
,, 6,	4204	Loveridge & Shoolbred, Wolverhampton	Coal scoop.
,, 19,	4205	C. S. Windover, Huntingdon	Phaeton.
,, 20,	4206	W. Hewitt, Birmingham	Connector.
,, 21,	4207	S. Last, Oxford-street	Bag.
		PROVISIONAL REGISTRATIONS.	
,, 3,	1109	R. Heath, St. George's-place	Spring.
,, 8,	1110	W. S. Mappin, Birmingham	Staff.
,, 17,	1111	A. A. D. Hely, Oxford-street	Stand.
,, 18,	1112	C. Watts, Harrow-road	Carriage pole.
,, 18,	1113	J. Tye, York-road	Violins.
,, 20,	1114	Clarke and Wilks, Fitzroy-square	Omnibus.

PRICES CURRENT OF METALS.

London, Oct. 25th, 1859.

		£ s. d.		£ s. d.	Dis.
IRON:					
Rails in Wales and North of England	pr. ton	6 0 0	to	6 5 0	nett
Welsh Bars, in Wales	,,	6 17 6	,,	6 0 0	3
Staf. Bars, at the Works	,,	7 0 0	,,	7 10 0	2½
,, Hoops	,,	8 0 0	,,	8 10 0	,,
,, Sheets, Singles	,,	8 10 0	,,	9 0 0	,,
,, Nail Rods	,,	7 0 0	,,	7 10 0	,,
,, Boiler Plates	,,	8 10 0	,,	9 0 0	,,
Scotch Pig, M. Nos. Warrants, at Glasgow	,,	2 11 3	,,	2 11 6	nett
Do. No. 1, Good Brands	,,	2 11 9	,,	2 14 0	,,
Scotch Bars	,,	7 10 0	,,	8 0 0	,,
Swedish Bars, in London	,,	11 10 0	,,	11 15 0	2½
COPPER:					
Sheet and Sheathing	per lb.	0 0 12	,,	0 0 0	3
Bunch Cake and Tile	pr. ton	107 10 0	,,	0 0 0	,,
Best Selected	,,	110 10 0	,,	0 0 0	,,
Australian	,,	104 14 0	,,	110 10 0	,,
South American	,,	99 0 0	,,	101 0 0	nom
Yellow Metal Sheathing	per lb.	0 0 10	,,	0 0 0	,,
STEEL:					
Swedish Keg	pr. ton	19 5 0	,,	19 10 0	2½
,, Faggot	,,	21 0 0	,,	21 10 0	,,
TIN:					
English, Block	p. cwt.	6 16 0	,,	0 0 0	2½
,, Bar	,,	6 17 0	,,	0 0 0	,,
Foreign, Banca	,,	6 18 0	,,	7 0 0	nett
,, Straits	,,	6 15 0	,,	6 16 0	,,
TINPLATES:					
Charcoal, I.C.	pr. box	1 11 0	,,	1 12 0	3
Coke, I.C.	,,	1 5 0	,,	1 5 6	,,
LEAD:					
Pig, English	pr. ton	22 5 0	,,	22 10 0	2½
,, Spanish	,,	21 10 0	,,	22 5 0	,,
Sheet	,,	23 0 0	,,	23 5 0	,,
SPELTER:					
On the spot	,,	20 17 6	,,	21 0 0	nett
For arrival	,,	20 17 6	,,	21 0 0	,,
ZINC:					
English Sheet	,,	27 0 0	,,	0 0 0	1½
QUICKSILVER	pr. btl.	7 0 0	,,	0 0 0	1½

REMARKS.—All metals are in rather a depressed state, and scarce any business is being done. A feeling of much uncertainty prevails as to what effect political complications are to have on trade.

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

BATTERY, *Limp's Fort, near Portmouth.*—Parties desiring to tender are required to attend at the Royal Engineer Office, Portsmouth, 31st October, at 10 o'clock, to appoint a surveyor to take out the quantities in conjunction with the Government surveyor. Each party is required to pay two guineas for the quantities.

RAILWAY BUILDINGS, *Scotland.*—For the Maybole and Girvan Railway. For the erection of timber station-house at Maybole; timber booking office for Crosshall; cottage for level-crossing lodge at Kilkerran; stone-built goods shed for Girvan; timber station-house for Girvan; and tank, engine, and carriage shed of same material. Plans and specifications, secretary's office in Girvan. Further information from Mr J. Miller, 25 Northumberland-street, Edinburgh. Tenders, Nov. 7.

RAILWAY CARRIAGES, *South Eastern.*—For the supply of 80 new first-class, 20 new composite, and 25 new second class carriages, and 25 new brake luggage vans. Drawings, specifications, and patterns at station master's office, Bricklayer's Arms railway station, Old Kent-road, or further information of the company's carriage and waggon superintendent, Ashford, Kent. Sealed tenders endorsed "Tenders for Carriage Stock," to be delivered to S. Smiles, secretary to the Company. No date given.

FILTER BEDS.—A filter is required to be made. Apply to J. H. and R. C. Rawlins, Hope Mills, *Wrexham.*

SEWERAGE WORKS, *Scotland.*—Execution of the sewerage works within the burgh of Portobello. Plans and specifications of the works may be seen at the office of the Commissioners of Police, Portobello, and schedules of measurement, and any information required from Mr. Paterson, C.E., surveyor, 20 St. Andrew-square, Edinburgh. Tenders with Mr. A. Paterson, clerk to the commissioners, Nov. 5.

SEWERING, PAVING, &c., *Manchester.*—For the draining, paving, and flagging of Shrudley-road, from its junction with the Queen's-road to the river. Sealed tenders to chairman of committee, Tuesday, Nov. 1st, at the Town Hall, York-street, Cheetham. Plans, forms of tender, &c., Mr. William Francis, surveyor, Town Hall.

CHURCH, *Margate.*—For the erection of a new congregational church, Margate. Plans, &c., J. Danby, Esq., 3 Union-crescent, Margate. Information and bills of quantities, Messrs. Poulton and Woodman, architects, Reading. Tenders to Nov. 1st.

CORN EXCHANGE, *Wellinborough, Northamptonshire.*—For the erection and completion of a corn exchange and public rooms at Wellinborough. Drawings, &c., at the office of E. Sharman, Esq., architect, Wellinborough. Further information Messrs. Bellamy and Hardy, architects, 30 Broadgate, Lincoln. Tenders, Nov. 8th.

ROADS, *New Whittington, near Chesterfield.*—For the whole of the works required to be done in the formation and construction of certain roads and sewers at New Whittington. Specifications and copies of quantities at the Wellington Hotel, Whittington, or Messrs. Sadler and Wade's office, Barnsley, to the 30th Oct. Tenders, Oct. 31st.

CEMETERY, *Bath.*—For opening the ground for a cemetery in a piece of land situated behind the toll-house in the Lower Bristol-road, seven feet deep, and providing and placing in side drains 4-inch, and in the main drain 6-inch stoneware socket pipe. There will be about 750 yards of side and 250 yards of main drain. Tenders to Mr. J. G. Hayden, clerk to the burial board, No. 3 John-street, Bath, to Nov. 5th.

DESIGNS, SPECIFICATIONS, AND ESTIMATES FOR REBUILDING THE PARISH CHURCH, *Stroud.*—An organ, chancel, and vestry to be constructed at the side or sides of the chancel. A premium of £20 for the design approved. Plans to Messrs. Sidney, Biddell, and G. Edwards, Hon. Secs., Stroud, by Nov. 1st.

DESIGNS AND ESTIMATES FOR CEMETERY, CHAPEL, AND LODGE.—With entrance gateway and boundary wall, Bath. £10 10s. for the selected design should the architect not be employed to superintend the works. A plan, &c., to be seen Mr. J. G. Hayden, 3 John-street, Bath. Designs and estimates to Nov. 5th.

FOR THE PURCHASE OF TIMBER.—Larch, spruce, ash, beech, and other timber, and the underwood, in the parish of Millington, near Pocklington, belonging to St. John's College, Cambridge, to be pointed out by Mr. G. Bingham, of Millington. Tenders to the Bursar, of St. John's College, Cambridge to Nov. 7th.

BOILER INSPECTOR.—Wanted, a sound practical mechanic thoroughly acquainted with the details of steam engines and boilers, to act as a district sub-inspector. A knowledge of indicating engines required. Salary, £120 per annum.—Apply by letter, before 1st Nov. next, enclosing testimonials, to H. W. Harman, Esq., C.E., the Association for Prevention of Boiler Explosions, Manchester.

SMITH AND ENGINEER for the Industrial School at West Ham. Married man preferred. Wages 30s. a week without rations or residence. Apply in hand-writing and with testimonials to guardians of Whitechapel Union Workhouse, Charles-street, Mile End, New Town, by 6 p.m., Nov 1. Personal attendance also.

IRON MERCHANTS' TRAVELLER.—An experienced man who can give satisfactory reference and security.

ENGINEER'S BOOKKEEPER.—To keep a sets of books in an engineering factory where from 50 to 100 men are employed.—Must be qualified to take out quantities, take stock, and price cost book. Apply, stating age, salary required, and reference to Mr. G. Bower, St. Neots, Huntingdonshire.

TWO ENGINE KEEPERS, at the weekly wages of £1 each, with the usual rewards for the Vestry of St. Mary, Islington. Applications on or before the Monday, first one at 6 p.m. Personal attendance at that time, at the vestry office.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 4, 1859.

THE WRECK OF THE ROYAL CHARTER.

MANY circumstances conspire to make the wreck of the Royal Charter one of the most melancholy disasters on record. Not only are there the facts which must strike every mind —the unexampled quickness of the passage from Melbourne; her loss almost within hail both of a harbour of refuge (Holyhead) which she had just passed and of the port for which she was destined; the wholesale swallowing up of almost all on board, and so forth; but there are other facts which are not so well known, but which add greatly to the sadness of the event. The Royal Charter, it will be recollected, was the ship in which the late Dr. Scoresby made a voyage to Australia and back expressly to observe and correct the errors of her compasses, so that the risk which iron ships run from compass errors was probably reduced in her case below that of every other vessel in our mercantile navy. Then again, the Captain who had command of the ship when she met her fate possessed the rare advantage of having made a long voyage in the vessel simply as a passenger, and therefore with ample leisure to study her qualities; for in 1856 Captain Taylor was sent to Melbourne in the Royal Charter by Messrs. Gibbs, Bright, & Co., to fit and bring home the William Monies, an old East India ship, and he made the voyage in her accordingly. Again, while it appears from the narrative of her first voyage that her complement of men and officers was then only about 85, at the time of her loss it was no less than 112, and she therefore had a most excellent chance of being handled efficiently. It was in despite of all these advantages that the Royal Charter came to grief.

It will not do to dismiss this event as a pure piece of misfortune altogether beyond the prevention of man, as some writers have done. One of our London morning journals tells us, for example, that "this melancholy catastrophe "was not the result of negligence or over-"confidence on the part of any one. . . . . No "prudence could have averted the disaster." This view of the matter may appear correct to some minds, but it certainly is not borne out by facts. The *Times* of Saturday last doubtless gave the true view when it said, "the origin of "the calamity seems to have been that in a "wild night, with a gale blowing that soon "became a hurricane, the ship was brought up "dangerously near a lee shore." It was doubtless graceful and generous of the *Times* to add, "let it be remembered, however, that Captain "Taylor was the last man seen alive on board;" but gallantry in his death cannot atone for unskilfulness in the life of a man to whose hands 500 other lives are committed. It is necessary to remind the public of this, because we cannot hold Captain Taylor innocent of error without drawing absurd and dangerous conclusions from the loss of his ship. The writer whom we first quoted, for instance, goes on to lament "that "no application of human ingenuity is able to "withstand the elemental rage," which, in itself, may be true, but which, nevertheless, implies an untruth. The Royal Charter may have been unable to "withstand" the elemental rage, but she was quite capable of retiring before it, and seeking shelter from it, had her journey not been persisted in after it became perilous. The evidence of the boatswain's-mate of the ship shows that at about eight o'clock on Tuesday evening the ship was "abreast of the "Skerries, distant about a mile and a-half." The wind had been so high all the latter part of the day that Holyhead had been held in sight for seven hours, and at this time (8 p.m.) so strong a gale was blowing that the ship made little or no progress, but was being carried by the wind and tide towards the shore. The *Times* correspondent at Holyhead, in his account of the Great Eastern's dangers, tells us that there the wind was east at eight o'clock on Tuesday evening; and on comparing all the reported statements, it appears that the gale blew from about the north-east upon the Royal Charter. Now, had the Captain put his ship round at this time, giving her as much sail as she could well bear, there was nothing whatever to prevent him from running either back into the open Channel, or into Holyhead harbour, with perfect safety. With no pilot on board he could not hope to enter the Mersey, and to go on, under such circumstances, with the gale growing to a hurricane, was mere madness. Yet on he went, actually seeking the lee shore which he might have avoided—beating along the perilous north coast of Anglesey, until point Ælianus (or 'Lynus) was passed, and a dead lee shore, of the cruellest kind, was well behind him. Nothing now was left but to "*withstand* the elemental rage," and anchor was accordingly cast. All the rest followed naturally enough. The anchors or the cables failed, the masts were cut away, the screw was thus fouled, and the ship went on the rocks. There are, it is true, some discrepancies in the various published narratives as to these occurrences, some stating the masts were cut away and the screw fouled before the ship struck, and others alleging that when she struck the screw was not fouled, but was put on at full speed to harden the wreck on shore; but these details are of no great moment. The fouling of the screw is always a very sure consequence of the cutting away of the masts, whether it occurred sooner or later in the present case.

Another false conclusion which has been drawn from the loss of the ship is, that the use of the auxiliary screw in passenger ships is baneful. The writer of a leading article in a respectable morning journal says, "we are "guilty of no presumption in drawing one "conclusion, and that is the worse than useless-"ness, the absolutely fatal mischief, of the so-"called 'auxiliary' screw." This remark is supported by the reflection that had there been no auxiliary steam power in the Royal Charter "she would never have been permitted to hug "a lee shore at night in search of a pilot, with "a hurricane dead on her weather bow, and a "strong in-draught to the shore." The reflection may be sound, but the conclusion is nevertheless untenable. We cannot afford to give up the advantage of steam power because here and there a man relies too much upon it. In the Royal Charter herself the auxiliary screw has proved of immense advantage. Dr. Scoresby, in his narrative of her first voyage, says, "Our "quick transit across the first two belts of light "winds and calms (on the journey out) by the "aid of our auxiliary steam power, is a result, "being one generally to be relied on, which "must give special advantage and popularity "in Australian voyages to ships possessing this "appliance, of far more consequence in passage "ships, as a relief from protracted oppressive-"ness, risk of sickness, and actual suffering, "than even from the gain of time in the gene-"ral passage." Again, he says, "Three or four "times an attempt was made (during a calm on "the voyage home) to improve our progress by "setting the lower topsails, but in all cases the "disadvantage in direction was far more than "the gain in speed. They seldom remained "on trial for more than an hour or two. The "steam-power, small as it was, was our grand "resource, giving us generally a six-knot speed, "and ordinarily yielding us a progress of 140 "miles or more in distance, and a gain of 2° or "2½° in north latitude." And in another place the Dr. states that the Royal Charter overtook a vessel on the homeward voyage, and found that her own steam power had enabled her to gain 4,000 miles upon the other vessel in 40 days; "the great advantage of possessing this "peculiar appliance admits," he adds, "of per-"petually recurring proofs."

The fact is, the Royal Charter has fallen a sacrifice to an undue passion for short voyages. A too great eagerness to reach the Mersey carried her on to the rocks of Anglesey. But few know what risks are now run in these "fast ships" in order to secure distinction in this respect. This fact also may be illustrated by reference to a former voyage of this very ship. The first gale that ever blew upon her, and which lasted with variations for 40 days, was made to drive her through more than 8,000 miles of distance, under a pressure of sail which would have proved fatal to her and all on board had any failure in the steering-gear, or any defect in its management, occurred. "No one experienced "in scudding before a fierce gale and a heavy "sea, and knowing how the safety of the ship "depended on the steering," said a passenger then on board of her, himself formerly a captain of merchantmen, "could contemplate "the possible failure in apparatus, gear, or "management of the helm of the Royal Charter, "when so scudding under the violence of this "terrible cyclone and tremendous sea, without "much anxiety." This is the sort of thing that is happening every day, the sole reason being that men in these days make so much unhappy haste to be rich, forgetting the proverb, "He that maketh haste to be rich shall "not be innocent."

There is another consideration which we dare not suppress. There seems great reason to fear that the Royal Charter was really a very inferior ship—inferior, we mean, in point of strength. It is difficult to believe that a well-constructed and well-built ship—a ship formed of good material well put together—could have become so utter a wreck as she became in so short a time. This is a matter which may be, and should be, inquired into. Portions of the iron of her hull may be obtained and examined, and the detailed drawings of the ship may be got at. Let this be done. Let, also, as much information relating to her actual construction as can be obtained be secured, that we may ascertain, if possible, why she yielded so swiftly to seas which some ships, some iron ships even, would have withstood for many hours, not to say days. There are other facts, beside that of her rapid break-up, which indicate great weakness in the Royal Charter. On her very first voyage she had to put back to Falmouth, after being six days out, in order not only to improve her trim, but to make her sound and water-tight if possible. "From the day "after our sailing," says a passenger, "much "wet had passed through the seams of the deck, "by the skylights and bulls'-eye lights, screw-"bolts, &c. After the commencement of the "westerly gale, the water had flowed down in "such quantities that all the third-class, and "most of the second-class, and some of the first-"class cabins were more or less flooded." This looks like the result of weakness. Moreover, on this and the return voyage her straining was much complained of. On the latter she leaked very considerably in the foremost compartment,

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requiring a donkey-engine to keep the leak under. "But the source and anxiety of alarm," says Dr. Scoresby, "was the discovery of "weakness and too susceptible working of "some of the plates and angle-irons near the "junction of the stem with the keel. Some "support had been applied within to the "upper part of the weak place; but the "apprehension of a risk of forcing off the "plates had hitherto prevented any appliance "to the latter part, where as the external pres-"sure varied as the ship plunged, the working "was most considerable. The compartment "itself, happily, was but small, and it was "thought to be securely water-tight, having in "the outset of our voyage been filled, as a tank, "with fresh water. But in the case of plates "working loose, or, by working, cutting off the "heads of the rivets, as was feared, it was "impossible to calculate on what the effect of "the entire displacement of a plate or plates "in the bow might be, or where the mischief "might end." It is impossible to read these statements and not see in them an indication of that defectiveness of construction which seems to have manifested itself so fatally in Dulas Bay. The thing most to be apprehended in such cases is, however, inferiority in the iron of which the ship is built. We know that much inferior metal is sold as "ship iron," whereas there is scarcely any work in which excellence of material is more to be desired than in that of shipbuilding. This state of things should be remedied. In the name of Christian charity let us not expose our fellow-creatures to violent deaths, 500 at a time, for the mere difference in the price per ton between good and bad iron!

CUNNINGHAM'S SYSTEM OF REEFING SAILS FOR THE ROYAL NAVY.

WE have from time to time in this journal alluded to Mr. Cunningham's system for working the square sails of ships, more especially with reference to its extensive use in ships of the mercantile marine. It is now with much pleasure that we observe its introduction into ships belonging to the Royal Navy.

About a year and a half ago Her Majesty's troop-ship Perseverance was fitted at Portsmouth on the "Cunningham system," upon the application of her late commander, John McDonald (who has thus been the means of introducing the system into the Royal Navy); and lately Her Majesty's ship Urgent has been also fitted at the same port upon the pressing request of her spirited commander, W. H. Hire. The first use of the system in Her Majesty's Navy was entrusted to Commander Edward R. Power, of the Perseverance, an old and experienced officer, who, after two voyages to the Mediterranean and one round the Cape of Good Hope in the winter time, has been called upon to report on the invention. We have been favoured with a perusal of the official report, from which we extract the following very striking passage:—"In variable winds and squally "weather, Commander Power was able to make "sail, and relieve the engines, when, with the "ordinary topsails it would not be judicious "even on account of harassing and exposing the "men to continued wet clothing, the efficient "number in the watch of Her Majesty's ship "Perseverance being so small."

We must now call attention to the following extract from a small work published by Mr. Cunningham six years ago, on the sail-power of steam-ships, by which it will be seen that the views which he then held regarding the advantages of his system to screw steam-vessels have been faithfully realized in practice:—"Hitherto I have only treated of my inven-"tion with reference to sailing vessels; but a "very important consideration of the subject "attaches itself to steam-vessels, and particu-"larly to those fitted with screw propellers. "I will, therefore, proceed to point out how "peculiarly adapted my invention is to steam "navigation. It has been shown that the top-"sails can be reefed by few men, and that, too, "without the exercise of any particular nautical "skill. On reflecting on these two very strik-"ing considerations, viz., that the operation "which now requires the assistance of the whole "crew, and all the nautical ability of the ship, "can be accomplished by a fraction of the num-"ber, and those untrained seamen, the impres-"sion cannot fail to be received, that such an "invention is peculiarly suitable to screw steam-"vessels, and so it is. There cannot be a ques-"tion but that a steam-ship, whether propelled "by screw or paddle wheel, should be in all "respects as perfect a machine as possible. The "utmost ability of man has been directed to-"wards this object, so far as the steam power "is concerned, but hitherto, although, by the "application of the screw propeller, the steam "power remains no longer a principal, but the "*sail* power resumes its ancient importance, "and the steam may be viewed only as an "auxiliary; still, *the bringing of that sail-power* "*under mechanical control* appears to have "been entirely lost sight of. The object which "has occupied the attention of the ablest engi-"neers for years to accomplish, viz., to bring "the navigation of a ship as much as possible "under the control of machinery, is thus over-"looked, and the steam-ship is relapsing into "the same troublesome machine to navigate "that it was 100 years ago, indeed more so, for "the immense yards and sails of our large "ocean screw ships are disproportionate to the "number of seamen comprising their crews; "and hence, in fact, all that has been gained "by the exercise and practice of years of pro-"found mechanical science, ingenuity, and skill, "is that *sailing* ships can be propelled in a "calm, and otherwise assisted by auxiliary "steam-engines; but most gravely must it be "considered, that this advantage has been ob-"tained at the sacrifice of an immense original "expenditure of capital, the requirement of an "enormous sustaining outlay, the sacrifice of "room for stowage, and other negative consi-"derations which really make it questionable "whether any advantage has been obtained at "all, particularly as it does not appear that "the brevity of the passages made by our large "screw steam-ships in any way compensates "for the vast expense involved in their support.* "I maintain, therefore, that one thing is yet "required in a screw steam-ship, or indeed any "full-rigged steam-vessel, and that is, to bring "the sail power more *under mechanical control.* "This will not only afford the means of reduc-"ing expense, by removing the necessity of "having a large crew of trained seamen, but it "will also give encouragement to commanders "to *make as much use of their sails as possible*; "it being reasonable to suspect, that under the "circumstances of large powerful sails, and with "few men to work them, sail is often taken in, "when otherwise it might be carried; such may "be inferred from the fact of many sailing "ships having made quicker passages to and "from Australia than the large and costly screw "steam-ships." Commander Power's report quite corroborated Mr. Cunningham's expectations, and the consideration for his men displayed by the Commander is an interesting feature in his report.

There can be no doubt that the question of improving the mechanical appliances for working the sails of ships, especially steam-ships, had become one of great importance. It was time to break out of the antiquated systems of ages, and at least attempt an improvement in this branch of nautical mechanical science, in which there has not been any marked change for upwards of 200 years. The introduction, therefore, of Mr. Cunningham's invention into the Royal Navy is a striking event in its history; and Commander Power's duty of making the first use of it has been an important one.

Although we have reason to know that the principal object which Mr. Cunningham had in view when he devoted his time and ability to the great work of introducing his invention into the mercantile marine was the saving of life; still, as the advantages and capabilities of the plan developed themselves, other considerations were suggested, and the expediency of applying it to ships of war was entertained. We again quote an extract from Mr. Cunningham's work before-mentioned bearing on this point:—"Hitherto I have confined myself to con-"sidering the applicability of my invention to "the mercantile steam navy, but it may further "be considered how far suitable it is to steam "ships-of-war. In action, the tactics of a war "steam-ship would doubtless be to depend on "the control of the steam-power alone; the "failure, however, of that power by damage to "the machinery would necessarily oblige her to "have recourse to her sails; and the ability to "apply the sail power with the utmost celerity, "and without exposing men aloft, would become "an object of the greatest importance. Here, "then, the advantages offered by my invention "are very apparent. A steam ship-of-war, "rigged and fitted in the manner before de-"scribed, would be enabled to go into action "with her topsails and topgallant sails rolled "snugly up on the yard, yet ready for instant "setting, without exposing men aloft. The "ability thus afforded would not only give "the ship a superior advantage in the event "of her machinery becoming disabled, but "would also enable her to use any of these "sails with great facility and effect in assisting "in the tactical movements of the ship."

We know that a reason given by naval officers for not using the Cunningham system in the Royal Navy is the necessity which there exists for keeping up the old method of working the sails, in order to exercise the crew aloft. This no doubt is very desirable, especially as it is to be feared that our seamen are not possessed of the same agility and skill that some years ago so greatly distinguished them from the seamen of other countries. But still, Mr. Cunningham's brief remarks on the application of his system to ships-of-war deserve serious attention. Steam-power has greatly altered the features of naval warfare. We shall no longer have, as a rule, fleets engaging each other under sail, when superior seamanship affords an advantage. Steam-power levels all these considerations, and the fleet which possesses the most expert artillerymen will be the most likely to win the battle. Why, then, cling pertinaciously to the continuance of exercises which occupy valuable time that would be well devoted to gunnery instruction. We shall watch the progress of Mr. Cunningham's valuable invention in Her Majesty's navy with much interest; and we trust at least that the equipment of Her Majesty's ships Perseverance and Urgent is the prelude to the fitting of all the troop ships and other shortly-manned vessels in the service.

The circumstance that the Cunningham system is now fairly introduced into the Royal Navy suggests the expediency of some means being adopted for the instruction of officers in the use of it. We hear that its operation is as simple as can be possibly conceived, and that

* We dissent from this. See previous article.—Eds. *M. M.*

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Mr. Cunningham has published copious instructions for the working of it. But still the proper *practical* working of it requires, no doubt, some previous acquaintance with its mode of action; and we can conceive the embarrassment of an officer of the watch being called upon to reef the topsails on a dark night by a method which practically he knows nothing about. Mr. Cunningham has a small yacht brig at Portsmouth fitted on his system, and he takes great pains to get the officers of ships fitted with his plan on board to instruct them in the working of it. But although this individual effort may answer its purpose as regards these particular officers, still, a general knowledge of the working of the system appears to be most desirable, especially with reference to the younger officers now being brought up in the service. The mizen-topsail of the school ship Conway, at Liverpool, is already fitted to instruct the lads in the new mode which, in the mercantile marine, is becoming almost universal; few new ships being now built without it, and a very large proportion of them already built being equipped on the "Cunningham system." The result of all this will be that in a short time the rising generation of officers, and, in fact, of seamen too, of the mercantile marine will know nothing about the old method of reefing topsails, and the officers of the Royal Navy will be equally ignorant of the new, with the exception of those officers who may have served on board Her Majesty's troop-ships fitted with the system. Whether, therefore, the system becomes general in the Royal Navy or not, the instruction of officers, and especially the rising generation, in the practical working of it, really becomes a subject demanding the consideration of Government.

We understand that there is something remarkable about the fitting of the Urgent. The yards of men-of-war are constructed in a different manner to those of merchant ships. The former are furnished with oak battens of considerable thickness towards the centre of the yard secured by hoops, while the merchant ship yards are without these battens. However, Mr. Cunningham has fully conquered any difficulty that might appear to exist, and the yards of the Urgent are remarkable for their snug appearance. Another peculiarity in men-of-war is, that they reeve their topsail-tyes through blocks upon each side of the topmast, while the tyes of merchant ships are generally led through sheave-holes. Mr. Cunningham has met this by having two neat iron blocks placed well forward on the topmast, which brings the lead of the chains nearly up and down. The advantage of all this has been, that the new system was applied without even the topmasts being sent down; indeed, from the time the iron work arrived from London, the yards and sails were all completed and ready to go aloft in *three days*. These are important considerations with reference to ships of war, as it shows that they can be very quickly altered to the new system, and without involving any great change aloft. It shows, too, that if need be the sails and yards can be fitted with the reefing gear, and yet still be used on the old plan for purposes of exercise; the reef beckets can be kept on the sails, and the toggles on the yards, and without interfering with the working of Mr. Cunningham's system, provided that the reef earings are unrove before the yard is worked. This is very important.

Mr. Cunningham in the work before alluded to points out the ability which his invention affords of sailing ships with fewer *regular* seamen in their crew. He instances a case where a ship, during the late war with Russia, proceeded to sea with a crew a large proportion of which were brickmakers; he also quotes the case of an American ship, the Hurricane, of upwards of 1,500 tons, having been navigated from Hong Kong to San Francisco with only twenty-five Lascars and three European seamen; neither of which, of course, could have been done if these ships had been rigged on the old plan. Now this appears to us to possess considerable political importance. There is no doubt that should we be ever again involved in a long Continental war, and the requirements of seamen for the Royal Navy be very large, as they will be, the only source from which we can look for seamen for the navy is the merchant service. The power, therefore, which the shipowner now has of sailing his ships with fewer regular seamen, would prevent the serious injury to trade which a large drain of seamen from the merchant navy would occasion. Moreover, it would help in a measure towards manning the navy in an indirect manner. The landsmen who would be entered on board the merchant ships to make up their crews would, after a few voyages, be eligible for ordinary seamen in the navy; and thus, indirectly, the supply of seamen would be kept up. It must be remembered that upon the old system few landsmen were entered on board of merchant ships; the shipowner could not afford to pay far labour comparatively useless to him; hence the few seamen which composed the crew were necessarily obliged to be skilled seamen, to do their duty aloft. It is not so now: the sturdy peasant will be as useful in heaving the anchor up and putting his strength to the ropes on deck, after he has got over his sea-sickness, as the seaman.

We may have occasion again to say a few words on this interesting subject. The fact is clear that a very important and marked change in the mode of working ships has been steadily establishing itself in the mercantile marine, and is now making its way into the Royal Navy, which involves deeper considerations than are at first sight of the subject perceived; and as a great maritime country we cannot but look at this change with the deepest interest. Although so dependent on our marine for our security and our glory, we have, as it were, until lately, most unaccountably been slumbering upon the subject of it. During the past forty years mechanical science of every description has undergone change and improvement, but the *sail* appears to have been comparatively lost sight of. It is true that the utmost energy and talent have been devoted to the perfecting of the application of steam propulsive power; but, to use Mr. Cunningham's term, the sail power has been neglected. That power which costs nothing, and by the mighty aid of which the new world was discovered, and the ends of it brought together, has not had its value properly esteemed. Its application to purposes of propulsion remained, until the production of Mr. Cunningham's invention, in the primitive condition of ages past.

Since commencing these remarks, we have received information to the effect that another of Her Majesty's troop ships has been ordered to be fitted by Mr. Cunningham—Her Majesty's ship Vulcan, at Portsmouth, at the request of Commander Strode, who commands her.

UNSINKABLE SHIPS.

THE extraordinary changes which modern ordnance has undergone, and is still undergoing, have led to many curious suggestions, and among the most curious may be mentioned a scheme first propounded by Mr. Charles Atherton, of Woolwich Dockyard, in the *Times* of Jan. 12, and the MECHANICS' MAGAZINE of Jan. 14, 1859, and revived by him in a recent number of the *Journal of the Society of Arts*. Mr. Atherton's object in the first instance was to make gun-boats, mortar-boats, floating-batteries, &c., invulnerable; and he asks—Why not make them up to the lines of their load displacements "solid masses" of material, of such specific gravity that they shall not sink however much they may be perforated by shot? He considered that a solid combination might be made of cork shavings, light wood sawdust, rush stems, cotton waste, flock, hemp, and other light material, by the aid of a solution of gutta-percha, or other chemical substance. This mass might be made, he thought, so tough that it could not be knocked to pieces by shot, and so light that it would be only one-half the specific gravity of water, and therefore unsinkable, however perforated by shot, and also capable of carrying an armament and naval equipment to the extent of nearly one-half the weight of its own displacement in tons. "Such vessels "of light draught accompanying fleets of war as "tenders to line-of-battle ships, whence they "might be manned and stored as occasion "might require, would, I submit," said he, "form a useful auxiliary available for shore "service, or for attacking land batteries, which "deep draught ships of the line cannot ap-"proach, and would be sunk if they could." The idea was first broached by him two years before as being applicable to the construction of vessels for carrying treasure.

In the interval that elapsed between the dates of Mr. Atherton's letters his ideas appear to have expanded enormously. We no longer hear of unsinkable "tenders to line-of battle "ships" only; but ships of war of all classes are to be constructed on the unsinkable principle. "I have no doubt," says Mr. Atherton "that at a moderate cost per ton of shipping, "existing vessels may be rendered unsinkable, "and that a new modification of ships of war of all "classes may be devised, such as may obviate "the horrors which appear to be otherwise "inevitable in maritime warfare under the fire "of modern ordnance." It ought to be stated that Mr. Atherton's reason for renewing his proposition at the present time, and in its enlarged form, is a belief of his (founded on a paragraph in the *Times*) to the effect that iron-cased ships will be incapable of resisting the fire of modern ordnance, and that, as recent events have shown, ships of the ordinary build may be sunk by the fire "even of an extempo-"rised Chinese fort."

There is, of course, one great primary obstacle to the carrying out of Mr. Atherton's plan, namely, that no such material as he requires for his purpose is at present known. The singular compound mentioned in his first letter does not seem to satisfy him now, and he therefore proposes that £250 be subscribed and placed at the disposal of the Council of the Society of Arts, to be awarded in premiums of £150 and £100, "for the discovery and specifi-"cation of the materials and process of manu-"facture most available for producing a com-"bination of materials constituting a solidifying "pulp possessing in the highest degree the pro-"perties of specific lightness, toughness, non-"absorption of water, and cheapness, or a "metallic cellular body having the same pro-"perties." But how a "metallic cellular body" is to answer the purpose we cannot conceive. It seems to us a very remarkable circumstance that Mr. Atherton loses sight altogether of the danger of fire, which is more likely to do injury than anything else now that the use of shells is universal in naval warfare. His light buoyant material must be presumed to be exposed to the fire of ordnance, for its whole merit is to consist in being unsinkable when "perforated"

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by shot or shell; and, consequently, unless it were uninflammable as well as unsinkable it would be of little use. Mere "lightness, "toughness, non-absorption of water, and cheap-"ness" alone will not therefore do. If we are wrong in this we shall be glad if Mr. Atherton will show us where our error lies; but he must not forget that "liquid fire" is as veritable a means of offence as the Armstrong gun, and has proved its efficacy quite as decidedly. Of course we are quite aware that a solid substance would not be set fire to by the mere lodgment of a red-hot shot in it, with no other access for air save the hole by which the shot entered. But the explosion of powerful shells within such a substance would be a very different matter, and would, we think, in most cases have the effect of setting it on fire. There can be no great harm in offering the premiums proposed by Mr. Atherton if there is the least chance of obtaining a very light fire-proof and water-proof solid material, because such a material would be useful for many purposes; we have no desire, therefore, to obstruct the action of the Society of Arts in this matter.

But, having said this, it remains for us to say further that even if such a material as we have spoken of should be produced, and placed in Mr. Atherton's hands, we should be disposed to ask wonderingly—What will he do with it? and we think the Society of Arts should consider this question before they accept his advice respecting the premiums. With a ship solid below the water-line where would he place the engines, coals, provisions, powder, and all those other stores which now are stowed in the lower parts of the ship? We know not how to conceive a plausible answer even to this question. Will Mr. Atherton kindly help us out of the difficulty? We hope he will, if possible, for his own credit's sake. It is easy enough for any man to make propositions in the form in which the present one comes before us; but it will not do for a gentleman who has taken a wrangler's degree at Cambridge, and made himself prominent in scientific discussions, to leave his propositions utterly undeveloped. It is, we think, incumbent upon Mr. Atherton to show us what the "new modification" of ships of war is to consist in, assuming that the material which he asks for is supplied. We should be heartily delighted to find that he has the design of the unsinkable war-ship in his mind. This, in our judgment, would be worth a very handsome "premium," and the Society of Arts would perhaps do well to offer one for it before they offer the others. They need not fear any very extensive competition. Of course it is quite possible to build enormous *rafts*, and call them by the new name of "unsinkable ships"; but these can hardly be what Mr. Atherton is thinking of, since he talks of rendering "exist-"ing vessels" unsinkable, and since he must know perfectly well that the time for abandoning real ships has not yet arrived. What, then, is he thinking of? We respectfully invite him to tell us.

COINING BY CONTRACT.

IT is not without an intense feeling of dissatisfaction that we have observed a paragraph "going the round" of the newspapers intimating, in terms too positive and plain to be misunderstood, that the Government intend putting the coinage of the new mixed metal monies out to contract. Our readers are well aware that the proposition for re-organising the inferior coinage of England was first promulgated—at the commencement of the present year—in the pages of the MECHANICS' MAGAZINE, and since that is the fact we naturally assume to ourselves the right of comment upon the mode to be adopted in the realisation of the great reform. There is no manner of doubt that the establishment for making the national monies—the Royal Mint—might, with an amount of outlay upon new mechanical appliances and fitments inconsiderable in comparison with the advantages to be derived therefrom, be made quite equal to the task of which ministers have assumed the responsibility. The four or five hundred tons of bronze coins which would have to be pressed into being before the old copper could be entirely superseded would, with little expense, in the course of less than three years, and without any interference with the production of gold and silver coins, be struck on Tower Hill. Why, we ask—and the public no doubt will reiterate the question—"why are we to have a contractor in Birming-"ham employed to do the Mint's work?"

To us such an arrangement seems inexplicable. There is no sort of manufacture conducted by Government which requires in all respects so much caution and care as that of money, and no manufacture, therefore, which should be more jealously hedged in by restrictions and reservations. But here, without any shadow of good, pecuniary or otherwise, the carrying out of a great reform in the coinage is, to be entrusted to hands whose interest is not to produce pieces of money so perfect as to defy the cunning labour of the counterfeiter, but such as shall return the greatest amount of profit to themselves. Surely the Chancellor of the Exchequer has not thought sufficiently upon the subject, or he would not have sanctioned so gratuitously dangerous a proceeding. We say "have sanctioned" it, because from the terms of the paragraph in question it appears that sanction has positively been given to it. Let not the singularly favoured and fortunate firm in Birmingham who have obtained, without competition, at least *the promise* of being entrusted with the highly important duty of supplanting the worn-out copper with the new mixed metal coins, imagine that our remarks as to the profits to be made by the transaction are at all personal. That would be a great error; our criticisms are based on the laws which govern contractors in general, and not themselves in particular. They may, for aught we know to the contrary, be quite as disposed to make themselves worthy of the great occasion as any other firm in the kingdom, but they are subject to the commercial law which bids them "make as much out of the job" as they can. It matters not to us whether it be Messrs. A, B, C, or H, who undertake the task, we say it is not one for contract at all, and that the Government is in error in making it one. But we do not understand why (admitting for a moment that the Institution which we have, and which is kept up at a cost of some thirty odd thousand pounds per annum, is incompetent to the task), specifications should not be put forth to all and sundry engineers, button-makers, breastplate-makers, stampers of gas-fittings, &c., so as to give them also an opportunity of competing for the coinage. That would appear to be a course so completely in order—when once the question of contract or no contract is answered affirmatively—that it is impossible to understand why it has not been done in this instance. When it was proposed by Sir John Herschel, at the commencement of his mastership in 1852, to hand over the entire plant of the Mint to contractors, who were to be bound under heavy penalties to produce coin of proper weight, standard, and finish, and to be always under the control of officers of the establishment appointed by the Treasury, the opportunity of undertaking the contract was offered to the most eminent engineering firms in and out of London. But in this instance no such course has been adopted. "Kissing" has been said to "go by "favour," and so far as that pleasant operation is concerned the saying is doubtless just; but why the privilege of coining the monies of the State is to be subject to the same rule it is not easy to see. Perhaps in the course of two or three months, and when Parliament is sitting, some Member of the Government may enlighten us on the point.

At present, the fact that the initiation of a new coinage on a vastly improved plan, and which is destined to form an era in the minting annals of the country, is to be taken out of the guardianship of Her Majesty's coiners and put into those of a company of Birmingham contractors, is the one to which we have felt it proper to direct public attention, and in omitting to do which we should have omitted our own duty. We publish on another page a copy of the paragraph named, and have merely to say that the *Manchester Guardian* has been totally misinformed in regard to the fact that the firm referred to therein have "executed the "copper coinage for this country for many "years." We are in a position to assert that they have done no such thing. The Parliamentary returns will demonstrate the fact that from 1805-6, when the last coinage of copper took place at Soho, up to 1852, and from 1855 to 1859, the whole of the copper coins for Great Britain and her Colonies have been executed exclusively at the existing Mint on Tower Hill. If the other statements of the paragraph were as inaccurate as this with regard to the production of copper coin, why, it might be treated with silence; but there is, as we have said, truth in the averment that new engines and new coining presses are being prepared for Birmingham contractors, and we allow the paragraph to speak for itself.

THE GREAT SEAL PATENT OFFICE LIBRARY.

WHAT is to be done in the matter of the Great Seal Patent Office Library? Over and over again the manifest want of increased accommodation, not only for the readers who frequent it, but even for the very books, has been pointed out by the London press, from the *Times* downwards, and yet nothing has hitherto been done. At the present moment the wretched passage which is by courtesy deemed a part of the library itself is actually being blocked up with shelves, in order to afford standing space for the newly-arriving volumes. As the Commissioners of Patents appear to be so entirely neglectful of inventors and others, who contribute goodly sums annually to the State, we turn to Mr. Edmunds, the Clerk to the Commissioners, who must possess considerable influence in the matter, and we ask him to see that something is speedily done. We know he has but little time to give to the subject, because his large private business as estate-agent in the north, coupled with his duties as Reading Clerk and Clerk for Private Bills in the House of Lords (for which he receives but a paltry £1,500 a year), together with other engagements, must necessarily absorb much of his time and energy. But then, as he receives £1,000 per annum from the fees of patentees, we have some claim upon his attention, and would rather have his services bestowed upon the improvement of the library than upon anything else.

For it is perfectly manifest that a public library in connection with the Patent Office has become indispensable. It is the only simple means which can be afforded to inventors for enabling them to act justly to themselves and honestly to each other. There must be a place

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in which they can make reference to the specifications of former patents, and to standard works on scientific subjects. Moreover, the attendance at the present gloomy cavern proves how needful a library is felt to be.

Mr. Edmunds must see all this, and we ask him to act upon what he sees. And we do so with the best of intentions, for we assure him that his past inactivity in the matter is inducing people to believe that he is more than inactive—that, in fact, he is hostile to the very existence of the library. It is time, therefore, that he took action, and proved that he is neither a slothful nor a faithless servant of patentees. A thousand a year may seem a trifle to a gentleman who has passed most of his life in a perpetual glow of patronage, and enjoyed many of the great gifts which Lord Chancellors and ex-Lord Chancellors are able to bestow. But to plainer men a thousand a year seems a considerable sum, and one which no man should put in his pocket until he has done *something* in return for it. This is the kind of thing that patentees are beginning to say, and it is only right that the gentleman in question should know it.

We appeal, therefore, to Mr. Edmunds. We are tired of appealing to Sir Richard Bethell, Sir Henry Keating, and their colleagues, although they really ought to support us cordially in this matter. Sir John Romilly, above all, being the only permanent Commissioner, ought to do his best for us. But Mr. Edmunds is the executive officer. We turn to him in this emergency, and we shall continue to look to him until something is done. We shall not cease to urge our claims upon his attention until our legitimate and pressing demands are complied with.

SUBMARINE TELEGRAPH CABLES.

It is useless to conceal the fact that submarine electric telegraph cables, as hitherto constructed, have been to a very great extent failures. There is great reason to doubt whether their insulation has ever been perfect even when they have left the manufactories; in many instances they have been greatly injured in transport from the works to their destinations; they have very frequently sustained great damage in the paying-out process; and, finally, they have been far too susceptible to injury even after submergence. All these things, of course, entail great expense and loss upon the proprietors of the cables—who are generally the shareholders of companies—and it is not at all surprising that effectual remedies have been sought.

With these facts before them, some persons have leaped to the conclusion that gutta-percha, which has been used as the insulating material in most of these failing cases, is not a suitable material for the purpose; but we are by no means prepared to go this length with them, because we know that much of the mischief has arisen from causes not at all assignable to the intrinsic qualities of the insulator. At the same time, whatever there may be to say in favour of gutta-percha, it appears beyond question that pure india-rubber is, to say the least, in all respects equal to it in this respect. Pure india-rubber properly applied is, in fact, a perfect insulator. Its proper application is, however, a matter of immense importance. How, then, may this be effected?

We honestly confess that we know of no method by which this is to be done with the same certainty of a good result as is secured by the system lately introduced by Messrs. Wells and Hall. We have, on a former occasion, directed attention to their plans; but, as we have lately had occasion to inspect the machinery completed for them by Messrs. Easton and Amos, we think it desirable to repeat our reference to them, especially as a company designed to carry them out is, we observe, in course of formation. Messrs. Wells and Hall—who, it should be remembered, have been engaged for many years in the manufacture and application of india-rubber in all its various forms—do not themselves hesitate to pronounce pure rubber much superior to gutta-percha for insulating the conductors of submarine telegraph cables. They tell us that, proceeding upon their own practical knowledge, they have selected as their insulating agent pure india-rubber, which has never before been used for the purpose, and which is capable of bearing much severer tests than it is possible for gutta-percha to sustain. "It is a well-known fact," they say, "that gutta-percha is a very impure "gum, and has in it a very large portion of "woody substance, which must decay, and ulti-"mately destroy the insulation. Moreover, "gutta-percha is liable to be very seriously in-"jured by changes of temperature, which must "consequently affect the insulation to a very "considerable extent. The patentees, therefore, "consider that the use of pure india-rubber, as "applied according to their method of insula-"tion, is the only permanent remedy for the "frequent failures which occur in the insulation "of submarine cables. The india-rubber used "in its pure state has," they continue, "many "advantages which gutta-percha does not possess. It is perfectly free from grit and every other impurity; it is also permanently *elastic* and capable of bearing without injury a very high degree of temperature, which is a most essential quality for all cables that have to be forwarded to various parts of the world. Telegraph companies are therefore assured that the cables manufactured by them will not be destroyed either by the process of paying out or by lying in the holds of ships while proceeding to hot climates. "The method of applying the "india-rubber according to the patent of "Messrs. Wells and Hall, admits of no defects "in construction, but insures a certainty of "electrical integrity which is altogether unex-"ampled." This is the language of the patentees themselves, and will therefore, of course, be of little value of itself; but we must admit they have grounds for their statement. By winding on successive ribands of the pure rubber, the whole process of manufacture can be watched at every stage, and it is difficult to see how any sort of defect can occur; while, by laying the successive ribands on partially over each other, and in opposite directions, even if a defect should occur in one fold it would be effectually neutralized by the next. These successive layers of india-rubber being again covered by a close-laid elastic cord, become so pressed and amalgamated as to form one perfectly sound and impervious insulator.

The external coverings of the cables thus insulated may be of various descriptions—either all of wire or in part wire, or in part a mixed covering of prepared hemp and wire, as may be desired. The coverings hitherto adopted have usually been made upon the spiral principle. The consequence is, they have a strong tendency to stretch and to kink, which sooner or later destroys the insulation. These evils are entirely obviated by the covering processes adopted by Messrs. Wells and Hall, in which the coverings are braided on in a new and peculiar manner. The machinery employed for this purpose (and which has been made with great care and skill by Messrs. Easton and Amos) is constructed upon the general principle of double hollow tube braiding machines, and so perfectly encases the insulated portions of the cable that the whole tensile strain is brought on the external covering which can be made to bear any required amount of strain without the least possibility of injuring the insulation, either in the process of manufacturing, or by elongation, or as it is being payed out from the vessel.

There are minor advantages in connection with this construction of submarine telegraph cables of which it is not necessary here to speak, our object being simply to endeavour to get the plan properly estimated. There are enormous interests at work in opposition to all great changes in telegraph cable construction, and nothing but the enlightenment of shareholders and the public will ever operate successfully in favour of improvement. We sincerely hope that the apprehensions which many feel in connection with the Government contracts for cables will be dissipated, and that the authorities will not fail to adopt a thoroughly reliable system of construction.

THE FOUNDER OF MECHANICS' INSTITUTIONS.

Mr. Carlyle tells us, and we all of course believe, that "no lie can live." A lie is repugnant to nature—aye, to God—and all the natural forces of the universe will war with it whenever they encounter it. It does not matter how great may be its origin, or how strong its supporters; it must, sooner or later, be blotted out.

Lord Brougham has this week been repeating at Newcastle-on-Tyne that old and dismal error of his about the founding of mechanics' institutions. George Birkbeck, he again says, was the author of them. "We seconded him, and no more. "We laboured as hard as we could, but he be-"gan it. He began it twenty years before he "established it in London. He began it at Glas-"gow, where he delivered a course of lectures to "working men. *This was the origin of mechanics' "institutions.* He then transferred it to London "for the sake of greater extension, and as being a "more important place for large support. *He it "was that propounded it in London also*, and not "only proposed it and furthered it, but spent "large sums of money upon it, which his family "have never been repaid. These were the services "of Dr. Birkbeck, and he it is that we must call "and always treat as the founder of mechanics' "institutes. He laboured, we seconded him, no "doubt, according to our means in our different "capacities. We were his fellow-labourers, but he "was the first and the originator of this great "step in social progress."

These are Lord Brougham's present statements. He is not insensible to our late strictures, for, in the words which we have put in italics first, he endeavours to avoid Mr. Robertson's claim to be the founder by pushing the origin of mechanics' institutions back to the time of the Glasgow lectures to working men. In the second italicised sentence, however, he makes the distinct assertion that Dr. Birkbeck first propounded the London Mechanics' Institution. The assertion is false—distinctly, unquestionably, demonstrably false! We have before shown why it is so; will Lord Brougham attempt to show the contrary? Assertion, even from him, and, although repeated a thousand times, is not proof. Mechanics' institutions sprung from the Mechanics' Magazine, and originated in the brains of its first editors, Mr. Robertson and Mr. Hodgskin. If there were no taint in Lord Brougham's noble nature he would say the same.

We are requested to state that that very beautiful building the Temple Church is again open (free) every day from ten till four. Divine Service on Sundays at eleven and three.

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ON THE TRANSMISSION OF HEAT OF DIFFERENT QUALITIES THROUGH GASES OF DIFFERENT KINDS.

THE following is an authorised abstract of a lecture recently delivered at the Royal Institution under the Presidence of H.R.H. the Prince Consort, by Professor J. Tyndall, F.R.S.:—

Some analogies between sound and light were first pointed out: a spectrum from the electric light was thrown upon a screen—the spectrum was to the eye what an orchestra was to the ear—the different colours were analogous to notes of different pitch. But beyond the visible spectrum in both directions there were rays which excited no impression of light. Those at the red end excited heat, and the reason why they failed to excite light probably was that they never reached the retina at all. This followed from the experiments of Brücke and Knoblauch. These obscure rays had been discovered by Sir Wm. Herschel, and the speaker demonstrated their existence by placing a thermo-electric pile near to the red end of the spectrum, but still outside of it. The needle of a large galvanometer connected with the pile was deflected, and came to rest in a position about 45 degrees from zero. A glass cell, containing the transparent vitreous humour of the eye of an ox, was now placed in the path of the rays: the *light* of the spectrum was not perceptibly diminished, but the needle of the galvanometer fell to zero, thus proving that the obscure rays of the spectrum, to which the galvanometric deflection was due, were wholly absorbed by the humours of the eye.

Reference was made to the excellent researches of Melloni. In a simple and ingenious manner he had proved the law of inverse squares to be true of radiant heat passing through air, and the eminent Italian inferred from his experiments that for a distance of 18 or 20 feet the action of air upon radiant heat was totally inappreciable. This is the only experimental result now known regarding the transmission of radiant heat from terrestrial sources through air; with regard to its transmission through other gases it was believed that we were without any information.

It was, however, very desirable to examine the action of such media—desirable on purely scientific grounds, and also on account of certain speculations which had been based upon the supposed deportment of the atmosphere as regards radiant heat. These speculations were originated by Fourier, but it was to M. Pouillet's celebrated Memoir, and the recent excellent paper of Mr Hopkins, to which we were indebted for their chief development. It was supposed that the rays from the sun and fixed stars could reach the earth through the atmosphere more easily than the rays emanating from the earth could get back into space. This view required experimental verification, and the more so, as the only experiment we possessed was the negative one of Melloni, to which reference has been already made.

The energetic action of the solid and liquid compounds into which the element hydrogen enters, suggested the thought that hydrogen gas might act more powerfully than air, and the following means were devised to test this idea. A tube was constructed, having its ends stopped air-tight by polished plates of rock-salt held between suitable washers, which salt is known to be transparent to heat of all kinds; the tube could be attached to an air-pump and exhausted, and any required gas or vapour could be admitted into it. A thermo-electric pile being placed at one end of the tube, and a source of heat at the other, the needle of an extremely sensitive galvanometer connected with the pile was deflected. After it had come to rest, the air was pumped from the tube, and the needle was carefully observed to see whether the removal of the air had any influence on the transmission of the heat. No such influence showed itself—the needle remained perfectly steady. A similar result was obtained when hydrogen gas was used instead of air.

Thus foiled, the speaker put his questions to Nature in the following way: a source of heat, having a temperature of about 300° C., was placed at one end of the tube, and a thermo-electric pile at the other—a large deflection was the consequence. Round the astatic needle, however, a second wire was coiled, thus forming a so-called differential galvanometer; a second pile was connected with this second wire, so that the current from it circulated round the needle in a direction opposed to that of the current from the first pile. The second pile was caused to approach the source of heat until both currents exactly neutralised each other, and the needle stood at zero. Here, then, we had two powerful forces in equilibrium, and the question now was whether the removal of the air from the tube would disturb this balance. A few strokes of the air-pump decided the question, and on the entire removal of the air the current from the pile at the end of the tube predominated over its antagonist from 40° to 50°. On re-admitting the air the needle again fell to zero; thus proving beyond a doubt that the air within the tube intercepted a portion of the radiant heat.

The same method was applied with other gases, and with most remarkable results. Gases differ probably as much among themselves with regard to their action upon radiant heat as liquids and solids do. Some gases bear the same relation to others that alum does to rock-salt. The speaker compared the action of perfectly transparent coal-gas with perfectly transparent atmospheric air. To render the effect visible to the audience, a large plano-convex lens was fixed between two upright stands at a certain height above a delicate galvanometer. The dial of the instrument was illuminated by a sheaf of rays from an electric lamp, the sheaf being sent through a solution of alum to sift it of its heat, and thus avoid the formation of air-currents within the glass shade of the instrument. Above the lens was placed a looking-glass, so inclined that the magnified image of the dial was thrown upon a screen, where the movements of the needle could be distinctly observed by the whole audience. Air was first examined, the currents from the two piles being equilibrated in the manner described; the tube was exhausted, and a small but perfectly sensible deflection was the result. It was next arranged that the current from the pile at the end of the tube predominated greatly over its antagonist. Dry coal-gas was now admitted into the tube, and its action upon the radiant heat was so energetic, the quantity of heat which it cut off was so great, that the needle of the galvanometer was seen to move from about 80° on one side of zero to 80° on the other. On exhausting the tube the radiant heat passed copiously through it, and the needle returned to its first position.

Similar differences have also been established in the case of vapours. As representatives of this diverse action, the vapour of ether and of bisulphide of carbon may be taken. For equal volumes, the quantity of heat intercepted by the former is enormously greater than that intercepted by the latter.

To test the influence of *quality*, the following experiment was devised. A powerful lime light was placed at one end of the tube, and the rays from it, concentrated by a convex lens, were sent through the tube, having previously been caused to pass through a thin layer of pure water. The heat of the luminous beam excited a thermo-electric current in the pile at the end of the exhausted tube; and this current being neutralised by the current from the second pile, coal-gas was admitted. This powerful gas, however, had no sensible effect upon the heat selected from the lime light; while the same quantity of heat, from an obscure source,* was strongly affected.

The bearing of this experiment upon the action of planetary atmospheres is obvious. The solar heat possesses, in a far higher degree than that of the lime light, the power of crossing an atmosphere; but, when the heat is absorbed by the planet, it is so changed in quality that the rays emanating from the planet cannot get with the same freedom back into space. Thus the atmosphere admits of the entrance of the solar heat, but checks its exit; and the result is a tendency to accumulate heat at the surface of the planet.

In the admirable paper of M. Pouillet already referred to, this action is regarded as the cause of the lower atmospheric strata being warmer than the higher ones; and Mr. Hopkins has shown the possible influence of such atmospheres upon the life of a planet situated at a great distance from the sun. We have hitherto confined our attention to solar heat; but were the sun abolished, and did stellar heat alone remain, it is possible that an atmosphere which permits advance and cuts off retreat, might eventually cause such an accumulation of small savings as to render a planet withdrawn entirely from the influence of the sun a warm dwelling-place. But whatever be the fate of the speculation, the experimental fact abides—that gases absorb radiant heat of different qualities in different degrees; and the action of the atmosphere is merely a particular case of the inquiry in which the speaker was at present engaged.*

* The *quantity* of heat is measured by the amount of the galvanometric deflection which it produces; its power of passing through media may be taken as a test of *quality*.

* While correcting the proof of this abstract, I learned that Dr. Franz had arrived at the conclusion that an absorption of 3·54 per cent. of the heat passing through a column of air 90 centimeters long takes place; for coloured gases he finds the absorption greater; but all colourless gases he assumes show no marked divergence from the atmosphere. —*Poggendorff's Annalen*, xciv. p. 337.

THE GREAT EASTERN AND STEAM-SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Woolwich Dockyard, 1st Nov., 1859.

GENTLEMEN,—With reference to Mr. Cheverton's objection (MECHANICS' MAGAZINE, No. 44, p. 284) "that the formula $\frac{V^3 D^4}{\text{Ind. h. p.}}$ does not do justice to the performance of the Great Eastern in the aspect of commercial excellence, namely, speed in conjunction with great transport capabilities and economic employment of power," and inviting my re-consideration of the subject, I beg to refer Mr. Cheverton to pages 15, 16, 17, and 18 of the appendix to the second edition of my "Essay on Steam Ship Capability," where he will find the superior dynamic capabilities of large ships, as compared with smaller vessels, in a mercantile point of view, fully recognized and demonstrated by five tables devoted to that subject, namely:—

Table No. 1, showing the SUPERIOR CAPABILITY of large ships as indicated by a progressively increasing rate of speed corresponding to a progressively increasing size of ship, the ratio of displacement to power being constant.

Table No. 2, showing the SUPERIOR CAPABILITY of large ships as indicated by the progressively reduced ratio of power to displacement corresponding to a progressively increased size of ship, the speed being constant.

Table No. 3, showing the SUPERIOR CAPABILITY of large ships as indicated by the progressively increasing distance capable of being steamed without recoaling at a given speed, and with a given per-centage of the displacement appropriated to cargo.

Table No. 4, showing the SUPERIOR CAPABILITY of large ships as indicated by the reduced consumption of fuel per ton of cargo at which goods will be conveyed a given distance, without recoaling, at a given speed.

Table No. 5, showing how soon the admitted advantages which result from increased size become neutralised if on the strength of increased size alone, we undertake OBLIGATIONS which involve, on the part of the large ship, an *increased rate of speed* combined with an *increased distance without recoaling*.

The investigations above referred to, as com-

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municated by me to the Institution of Civil Engineers, and published in April, 1854, present results conclusively demonstrative of the SUPERIOR CAPABILITIES of large ships in the commercial point of view to which Mr. Cheverton now revives attention; in fact, these papers were written by me when the keel of the Great Eastern was being laid, and when scientific and speculative enthusiasm were at their height, not merely to confirm the use of, but to caution the public as to the misuse which then appeared to me to threaten the introduction of leviathan ships. If Mr. Cheverton will now prosecute these investigations, taking, as he suggests, "the simple displacement as the factor and not the ⅔ power thereof," the result will, I venture to say, be the reverse of what he anticipates as respects doing justice to the commercial capabilities of the Great Eastern. But this leviathan is now afloat, ready to test the truth or fallacy of the theories that have been advanced, and although her capabilities for sea service as respects the mutual relation of displacement, power, speed, and coal have not yet been conclusively determined, it appears from the data of her passage from the Bill of Portland to Tuscar (MECHANICS' MAGAZINE, No. 42, p. 242 and 252) that with a displacement of (say) 17,500 tons, the distance, 400 nautical miles, was performed in 32 hours with a consumption of fuel at the rate of 250 tons per 24 hours, or 208·3 cwts. per hour, being at the average speed of 12½ knots per hour, with a consumption of fuel at the rate of 16·66 cwts. per knot. These data give a co-efficient of dynamic duty with reference to coal (by the formula $\frac{V^3 D^{\frac{2}{3}}}{W}$), equal to 6326.

On this assumption that the steaming speed of

12½ knots per hour requires 250 tons of coal per day;
13 " will require 281 tons per day;
14 " " 351 "
15 " " 432 "

it is, however, to be hoped that the construction of the engines and boilers of the Great Eastern is such as admits of the introduction of modern improvements, whereby the consumption of fuel with reference to speed may be greatly reduced.

It may be observed that on the passage to Holyhead, the engines were not continuously worked up to their full power, and, therefore, that the capability of the ship for continuous high speed was not fully developed. This consideration, however, will not materially affect the co-efficient of dynamic duty above deduced, for the consumption of fuel per hour when working at full power would be increased in about the same proportion as the cube of the speed would be increased, and, consequently, the co-efficient of dynamic duty by the above formula remains very nearly constant at whatever speed the ship may be driven, so long as the displacement is not materially altered.

The circumstances of the passage to Holyhead do not appear to have admitted of exact data being obtained as to the rate of consumption of fuel per indicated horse-power per hour by the screw and paddle-wheel engines respectively; but it being understood that the screw engines were worked with steam partially superheated, it is probable that the consumption may not have exceeded 3½ lbs. per indicated horse-power per hour, and on this assumption the co-efficient of dynamic performance with reference to displacement and power would be about 200. This is a low co-efficient for a mercantile steam-ship, but it is about as high as I have ever known to be realized by any vessel of which the ratio of mean draught to breadth was so small as in this case of the Great Eastern, namely, only 23 to 84, or 1 to 3·65. It may be expected to improve as the vessel shall be loaded down to a deeper draught. The question involving, as it does, the merits of the type of form of the ship, is of great importance, and it is to be hoped that the Great Eastern will not be allowed to go to her moorings at Southampton without having gone through the usual ordeal of a trial by repeated runs over the measured knot in Stokes' Bay, in addition to her sea-trials for determining the present co-efficients of her dynamic performance with reference to indicated horse-power, and of her dynamic duty with reference to her consumption of fuel.

I am, Gentlemen, yours very obediently,
CHARLES ATHERTON.

Proceedings of Societies.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

QUARTERLY MEETING. *Oct. 18th*, 1859.—William Fairbairn, Esq., F.R.S., &c., President, in the chair. The President announced the formation of a Mathematical and Physical Section in connexion with the Society. Dr. F. Crace Calvert presented, in the name of Mr. Arnaudon (from Turin), a paper, and samples of green colours used in painting and printing, and especially referred to two new chrome greens, one of which is a new compound, corresponding to the monohydrate of sesquioxyde of chrome $Cr^2 O^3 HO$. The author commences in his work to point out the qualities which a good green ought to possess, in order to be suitable for painting. Then he reviews in a few words the different greens which are found at present in the market, together with the nature and properties of the same. Beginning with the history of the works already published on this subject, he next gives the description of his process for preparing his monohydrate of sesquioxyde of chrome, and which consists in exposing the bichromate of potash mixed with phosphoric acid and any desoxydizing agent (for example, ammonia) for some time to the action of heat. The soluble salts are then removed by washing.

The green so prepared has not only a beautiful shade, but like that of Mr. Guignet (made by decomposing the borate of oxyde of chrome by water) possesses the curious property of remaining green under the influence of artificial light. Dr. Calvert also presented some muslins printed by M. Camille Kaechlin, of Mulhouse, with fuchsine, a product obtained from the aniline of coal tar. This colour was very remarkable from the exquisite bloom of the pink shade obtained when fixed with albumen.

The following extract of a letter received from Professor W. Thomson, F.R.S., Honorary Member of the Society, &c., was read by Dr. Joule.

"I have a very simple 'domestic' apparatus by which I can observe atmospheric electricity in an easy way. It consists merely of an insulated can of water to set on a table or window-sill *inside*, and discharge by a small pipe through a fine nozzle two or three feet from the wall. With only about ten inches head of water and a discharge so slow as to give no trouble in replenishing the can with water, the atmospheric effect is collected so quickly that any difference of potentials between the insulated conductor and the air at the place where the stream from the nozzle breaks into drops is done away with in my apparatus at the rate of five per cent. per half second, or even faster. Hence a very moderate degree of insulation is sensibly as good as perfect, so far as observing the atmospheric effect is concerned. It is easy, by my plan of drying the atmosphere round the insulating stems by means of pumice-stone moistened with sulphuric acid, to insure a degree of insulation in all weathers, by which not more than five per cent. per minute will be lost by it from the atmospheric apparatus at any time. A little attention to keep the outer part of the conductor clear of spider lines is necessary. The apparatus I employed at Invercloy stood on a table beside a window on the second floor, which was kept open about an inch to let the discharging tube project out without coming in contact with the frame. The nozzle was only about two feet and a half from the wall, and nearly on a level with the window-sill. The divided ring electrometer stood on the table beside it, and acted in a very satisfactory way (as I had supplied it with a Leyden phial consisting of a common thin white glass shade, which insulated remarkably well, instead of the German glass jar—the second of the kind which I had tried, and which would not hold its charge for half a day). I found from 13½° to 14° of torsion required to bring the index to zero when urged aside by the electromotive force of ten zinc-copper water-cells. The Leyden phial held so well, that the sensibility of the electrometer measured in that way did not fall more than from 13½° to 13° in three days. The atmospheric effect ranged from 30° to above 420° during the four days which I had to test it—that is to say, the electromotive force per foot of air measured horizontally from the side of the house was from nine to one hundred and twenty-six zinc copper water-cells. The weather was almost perfectly settled, either calm, or with slight east wind, and in general an easterly haze in the air. The electrometer twice within half an hour went above 420°, there being at the time a fresh temporary breeze from the east. What I had previously observed regarding the effect of east wind was amply confirmed. Invariably the electrometer showed very high positive in fine weather, before and during east wind. It generally rose very much, shortly before a slight puff of wind from that quarter, and continued high till the breeze would begin to abate. I never once observed the electrometer going up unusually high during fair weather without east wind following immediately. One evening in August I did not perceive the east wind at all, when warned by the electrometer to expect it; but I took the precaution of bringing my boat up to a safe part of the beach, and immediately found by waves coming in that the east wind must be blowing a short distance out at sea, although it did not get so far as the shore. I made a slight commencement of the *electro-geodesy* which I pointed out as desirable at the British Association, and in the course of two days, namely, October 3rd and 4th, got some very decided results. Macfarlane, and one of my former laboratory and Agamemnon assistants, Russel, came down to Arran for the purpose. Mr. Russel and I went up Goatfell on the 3rd inst. with the portable electrometer and made observations, while Mr. Macfarlane remained at Invercloy, constantly observing and recording the indications of the house electrometer. On the 4th inst. the same process was continued to observe simultaneously at the house and at one or other of several stations on the way up Goatfell. I have not yet reduced all the observations, but I see enough to leave no doubt whatever but that cloudless masses of air at no great distance from the earth, certainly not more than a mile or two, influence the electrometer largely by electricity which they carry. This I conclude because I find no constancy in the relation between the simultaneous electrometric indications at the different stations. Between the house and the nearest station the relative variation was least. Between the house and a station about half way up Goatfell, at a distance estimated at two miles and a half in a right line, the number expressing the ratio varied from about 113 to 360 in the course of about three hours. On two different mornings the ratio of house to a station about sixty yards distant on the road beside the sea was 97 and 96 respectively. On the afternoon of the 4th inst., during a fresh temporary breeze of east wind, blowing up a little spray as far as the road station, most of which would fall short of the house, the ratio was 108 in favour of the house electrometer—both standing at the time very high—the house about 350°. I have no doubt but that this was owing to the negative electricity carried by the spray from the sea, which would diminish relatively the indications of the road electrometer."

A paper was read by Mr. Hopkins, entitled "On Irregularities in the Winter Temperature of the British Islands."

The Chairman of the Great Eastern Company has forwarded a telegram to J. R. Stebbing, Esq., to the effect that the great ship sailed from Holyhead on Wednesday at 12 30 for Southampton, where she may be expected this evening (Friday).

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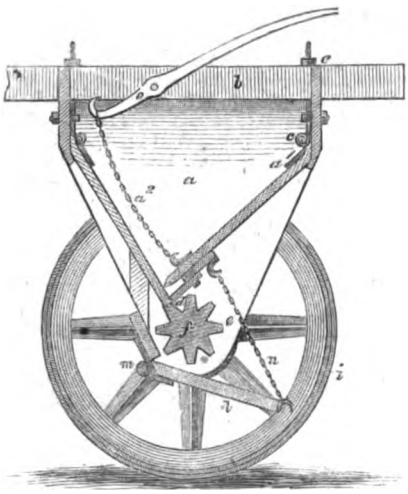
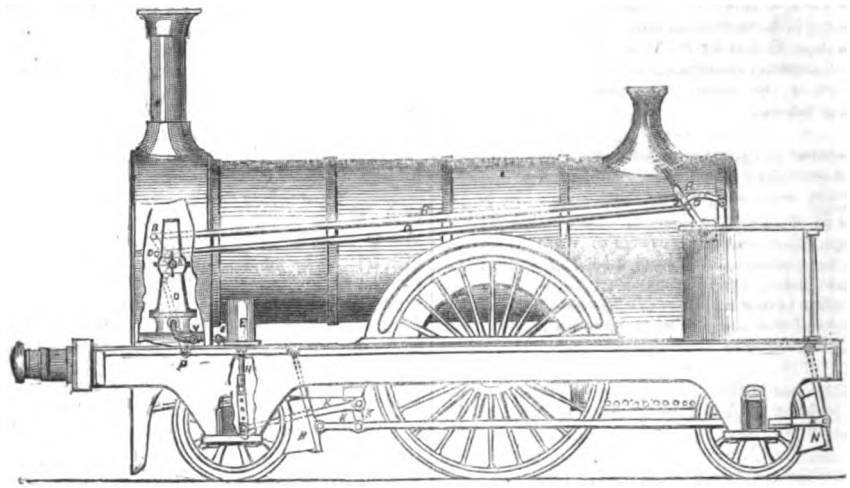
NEWINGTON'S APPARATUS FOR DISTRIBUTING SEEDS AND MANURE.



DR. SAMUEL NEWINGTON, of Ridgway Ticehurst Sussex, has just completed a patent for the apparatus for distributing seeds and manure represented in the annexed engraving. This apparatus is applicable for distributing guano, lime, and all kinds of dry pulverized manure, and for distributing corn, grass, and other like seeds broadcast. *a* is the hopper, to the upper part of which the shafts *b b* are attached. The side *a'* of the hopper turns at its upper edge on the hinge *c*, so that the lowest edge of the side *a'* can be moved to or from the lower part of the side a^2; to the lower part of the moveable side *a'* are bolted projecting pieces *d d*. A vibratory motion is communicated to the side *a'* by projecting blades, or teeth, *e*, on the axis *f*. On this axis there are two ratchet wheels, into which pawls (turning on pins fixed to the bosses of the wheels *i*) are pressed by means of springs, which are also fixed to the bosses of the wheels, so that the axis *f* is only caused to rotate when the machine is drawn forwards; the rotation of the axis *f* causes the projecting blades *e* upon it to strike in succession against the projecting pieces *d* fixed to the moveable side *a'* of the hopper, and so give to it a vibratory motion. The moving the side *a'* towards and away from the side a^2 allows the seeds or manure to fall on to the blades *e* on the axis *f*, and as the axis rotates, the seeds or manure fall on to the board *l*, and the vibratory motion of the side *a'* also keeps the manure in the hopper agitated. The board *l* at one edge turns on the hinge *m*, and a vibratory motion is communicated to this board by its being connected by the chains *n* to the vibrating side *a'* of the hopper, and the seed or manure will thus be shaken off this board on to the land. The hinge *c*, upon which the moveable side *a'* turns, can be raised or lowered by screwing or unscrewing the nut *c'*, and the distance between the end of the side *a'* and the lower part of the side a^2 can thus be varied, and by this means the amount of seed or manure distributed on to the land can be varied. When it is desired to stop the seed or manure from descending from the hopper, the end of the side *a'* can be drawn against the side a^2 by depressing the long arm of the lever *o*. A greater quantity of seed or manure may be allowed to fall from the hopper by turning the pieces *d d*, so that they are not acted on by the teeth *e* on the axis *f*; the teeth *e* will then strike against the end of the moveable side *a'* of the hopper. A still greater amount of seed or manure may be allowed to fall from the hopper by raising the side a^2 of the hopper away from the blades on the axis *f*; for this purpose the side a^2 is carried by hinges which can be raised or lowered in a similar manner to the side *a'*.

In arranging the apparatus for distributing seeds or manure in furrows, a box containing the seed or manure is placed inside the hopper, and attached to the moveable side *a'*, and holes are formed through the side *a'* near its lowest edge. and through the box containing the seed, and as the machine moves forwards the seed or manure is shaken out through these holes into funnels carried from the fixed ends of the hopper, and is by them guided into the furrows, or the seed or manure may fall on the platform *l*, and be guided into the furrows by pieces of wood screwed on the board at intervals. The holes in the side *a'* and in the box are kept clear by means of wires; these wires are fixed to a bar passing along the upper part of the hopper, and pass down through the seed or manure to the holes, and as the side *a'* is moved to and fro, the wires enter and leave the holes, and so keep the holes free. Proper apparatus for forming the furrows may be attached to the front of the machine.

ALLAN'S APPARATUS FOR RETARDING AND STOPPING RAILWAY TRAINS.



AN IMPROVED METHOD OF RETARDING AND STOPPING RAILWAY TRAINS.

By ALEXANDER ALLAN, Engineer, Perth.

IN the prevention of collisions, and their consequently serious results, a few seconds are most valuable: the danger also is, in most cases, first seen by the man in charge of the engine. The object of these improvements is, therefore, to give the driver increased power of controlling the speed of, and in stopping the trains; and for this purpose, and in order that the whole break power of any train may be brought into requisition in the shortest possible time, it is recommended that, in addition to the apparatus to be hereinafter described, a cord shall be placed within convenient reach of the men on the engine, communicating with a bell fitted up in the first break-van, by which means the guard may be apprised of his assistance being required at the van-breaks.

The improvements consist of two distinct parts. 1st. By inserting a throttle or other valve in the exhaust-pipe of the engine at *A*, so that by means of a connection *B* the driver can fully or partially close the valve *A*. By the table of experiments appended, it will be seen, that by the closing of this valve (the regulator being at the same time open), a retarding force is opposed to the engine of equal power with the tender breaks, and for all *ordinary* stoppages this can be used to bring the train almost to a dead stand—the tender break being applied only for say the last dozen yards, thus effecting a great saving in the permanent way, tender-tyres, and break-blocks.

The second part of the improvements consists of a steam break to work in connection with the above valve in cases of great danger. The steam is taken from the exhaust-pipe by means of the pipe *C* which is supplied by a stop-cock or valve *V*, worked from the foot-plate by the connection *D*, which being separate from the connection *B*, it will be seen that one or both of the retarding forces may be used at pleasure. The steam from the pipe *C* passes to cylinder *E*, actuating the piston *H* and levers *K*, &c., and break-blocks *N*, which may be applied to all the wheels if desired, but by preference they are shown attached to the leading and trailing wheels only of passenger engines. On the steam being released, the weight of piston, rods, and levers will free the break-blocks from the wheels.

By partly closing (more or less) the throttle-valve, trains may be controlled when passing down steep inclines to any desired speed, leaving in reserve (in the case of heavy goods trains especially) a great surplus of break-power to bring the train to a stand quickly on any incline—namely, that of the steam-break herein described, and also that of the tender and van-breaks. In illustration of this, an experiment, not included in the table, resulted as follows:—On an incline of five miles, the gradients averaging 1 in 80 (descending), and with a gross load, estimated at 200 to 210 tons, the throttle-valve alone controlled the train from a starting speed of thirty miles per hour to fifteen miles per hour over the whole distance.

The partial closing of the valve may also be made to prevent violent slipping, as the wheels will only revolve in proportion (*i.e.*, the traction will only be equivalent) to the quantity of steam allowed to escape from the exhaust-pipe, and this may be regulated to any extent by the valve, which can be worked with greater ease and nicety than the regulator.

With regard to reversal, it is known to be extremely difficult, if not impossible, to reverse an engine at speed, but it will be seen that, with full steam on the pistons, the closing of the throttle-valve, which is not effected by speed, produces a result quite equal to that of reversal, whilst reversal itself is facilitated by a greater equalisation of the pressure on both sides of the valves, and an increased break-power is obtained (see Table) without the usual objectionable results of reversing the engine whilst in motion.

The combined effect of these appliances may further be shortly stated to be,—

1st. By the throttle-valve alone a power is exerted equal to that of the tender breaks.

2nd. By use of the tender-breaks in combination with the above, a doubling of this power is obtained

3rd. By using the engines' steam break-blocks, the throttle valve, and the tender breaks together, a retarding power equal to triple that of the tender breaks alone is brought out.

4th. In addition to the above, by reversing,

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this retarding power is still further increased, and

5th. By the recommended communication from the engine to the van, used in combination with the whole, a power of stoppage is obtained, which has not hitherto been equalled, and within much less time. This last is the most important element, as all necessary manipulations can be gone through in one or two seconds after their requirement being noticed.

TABLE.

Abstract of experiments with a gross load of 85 tons, made up as under:—

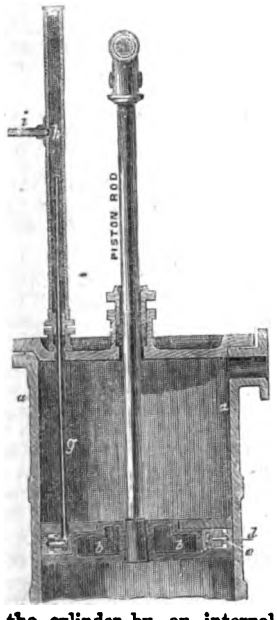
Engine	18 tons.	85 tons. Weather calm; rails dry.
Tender	12 ,,	
11 Empty carriages.	55 ,,	

Gradients.—The first ¼ mile from the post at which the break-power was applied was level. The next ¼ mile further, 1/96 rising gradient. In every case, the retarding force was applied at the same mile-post on the same line of rails. The carriage-breaks were not applied in any case.

Number.	Seconds to ¼ mile.	Miles per hour.	Seconds to stop in.	Distance run yards.	Class of Break, and Remarks.
1	25	36	156	1432	No breaks applied.
2	25	36	80	800	Throttle valve only used. Valve leaky did not bring the train to a *dead stand*. Speed was very slow for the last ⅛th of a mile.
3	25	36	66	715	Tender break only.
4	24	36½	63	710	Throttle valve closed, and engine reversed.
5	25	36	50	460	Throttle valve closed, engine reversed, and tender break used.
6	25	36	55	450	Throttle valve closed, and tender break used.
7	25	36	50	400	Throttle valve closed, and engine steam-break applied.
8	25	36	30	275	Throttle valve closed; engine steam-break and tender-break applied.
9	25	36	23	220	Throttle valve closed; engine reversed, steam-break and tender-break used.

NOTE.—The results as per table were obtained from an engine with the throttle-valve and steam-break fitted up only in a temporary manner. With the apparatus more perfectly applied better results would necessarily be obtained.

GARFORTH'S IMPROVEMENTS IN STEAM PISTONS.



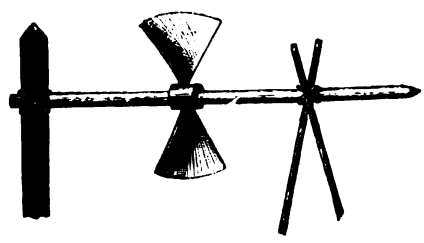
Messrs. W. and J. Garforth, of Dunkinfield, Chester, have just patented an invention designed to obtain a sufficiently tight packing between the piston and cylinder to ensure its being steam-tight, without the necessity of exerting more pressure, and causing more friction between the piston and cylinder than is absolutely required to effect a steam-tight packing. The improvement in the piston for effecting the desired purpose consists in an outer ring or rings of ordinary construction, which are to be expanded against the cylinder by an internal V ring made in sections, each of such sections being provided with a small piston or pistons, one end of which acts upon the V ring, and the other receives the direct pressure of steam which is supplied and conveyed to an annular space in the interior of the piston by a steam pipe, which rises and descends through a stuffing-box in the cylinder cover with the action of the piston. In this arrangement it will be evident, that by so applying the action of steam to the expanding V piston ring, the pressure of such steam, and, consequently, the piston packing, may be so regulated as to admit of a pressure being exerted, sufficient only to maintain the piston packing in steam-tight contact with the interior of the cylinder. The accompanying engraving is a vertical sectional view of a cylinder and piston, to which the improved steam-tight packing is shown applied, clearing illustrating the method of applying the steam to the packing ring by means of the pistons and V wedges. *a a* is the cylinder, and *b* the piston; *c c* being the packing rings, and *d* the annular V wedges which force the packing rings into contact with the interior of the cylinder, by means of the small horizontal pistons *e e*, against which the steam exerts pressure; the steam being supplied to the annular cavity *f* behind the small pistons *e e* by means of the pipe *g*, which rises and falls with the piston *b* through the stuffing-box in the cylinder cover, and receives the steam from the chamber *h* which is supplied by the steam pipe *i*. Thus it will readily be seen, that the pressure of the piston packing against the cylinder may be regulated according to the amount and pressure of steam supplied to the annular cavity or chamber *f*.

THE SCREW AND THE PROPELLER:

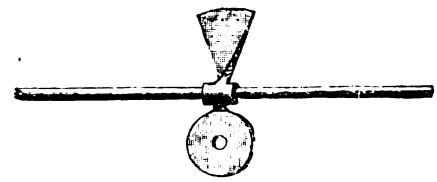
THEIR PROPERTIES, THEIR INVENTORS, AND THEIR IMITATORS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—It is now thirty years since the writer of these remarks first became acquainted with the propelling properties of the screw, during which period, wishing well to the interests of its poor and ingenious inventor, he has watched in confidence its progress of improvement as a marine engine with much disappointment, yet with no common interest. The little history of this much coveted instrument of jealousy is simply this:—When eight years of age, George Blencowe, then living at Barnet, seeing his mother's servant trundling a mop, cut a hedge stake out of his father's garden, and with a bit of paling crossed and a few twists of a cord round its shaft as it lay transversely in a punt with two sticks across to rest its spindle upon at its stern, spun it as boys do a water cutter made of a round bit of tin or a penny piece with a hole and string through it, propelling its little freight across a duck-pond as true as an arrow, and with a celerity, to his astonishment, equalled only by the ducks scudding before it, to the great delight of the old people looking on behind the lattice at the energy and ingenuity of their little Georgy. It so happened, as the boy grew up, that he made friends of a favourite companion of his father's, an excellent mechanic and clock-maker named Shorter. To him George opened his heart, his friend the while exhibiting to his pupil the fly-wheel of a smoke-jack, from which, after depriving it of four of its fans, they constructed after a rough fashion the following screw in a right line with its spindle, with the original bit of paling at the end of it:—

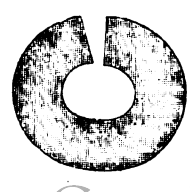


This, it must be admitted, was not a bad beginning, but still it didn't do as well as the primitive and original contrivance of the mere mop-stick and paling. Mother-wit, which is seldom at a loss at a pinch, soon suggested the separation of their beloved idea, and out of the united fertility of their contrivance, sprung their next essay out of the bottom of an old saucepan, long having done duty as a stop-gap to the cocks and hens in the back garden. Of course the family shears in the shape of sundry scissors came in for their share of the anticipated benefit of the dear boy's genius for mechanics, which Mr. Shorter very unceremoniously applied to the purpose of turning out specimens of propellers as numerous as they were omni-genous. Even the garden shears with which the old gentleman had used to cut out the peacocks for half-a-century in the forecourt were embedded in the stump of an old tree as a vice, and did duty in paring and pruning bits of tin till they became, with the assistance of a string and a pin, as geometrically correct as a pewter platter, and flourished awhile at one side of his screw stick with a shoulder of mutton blade-bone at the other, as under, till the junction of bone and tin relapsed into a divorce by sheer practical exhaustion:—



From this severance of their profound idea sprung another device worthy of Archimedes himself, the bit of tin having the preference of their choice, and the blade-bone giving way to be the more useful, as the sequel will show, for the future prospects of the youthful and enterprising mechanical aspirants.

We now leave awhile incipient mechanism and disappointments for the broader field of invention, as it opens to one's view in the varied lustre of its beautiful phases as they flit before genius. It occurred about the year 1832, during the interval of a little adult schooling and experience, that the old trial of the screw, for the sake of practice, as an engineer, the boy, now a man, ought to revive; and under the bettered circumstances of George's acquired store of knowledge, being now master of the first principles of geometry, his resolution was taken to prosecute and perfect the old invention. Accordingly, the energies of the old people took fire at George's genius, and burnt briskly as they set to work to exhume the dry bones of his early labours out of the back shed, where they had rested so long undisturbed, for the reflective benefit of the bats and owls that had looked upon them with a jealous eye as something sacred to their snug Arcadia. Esquire Hearty, who had kindly consented to the young man's application to try his skill as a mechanician upon his lake, promoted his young neighbour's aspirations of industry, it being his pride to love and be beloved, and to share in the happiness of all within his social circle; and though George at this time fought hard against fortune, a kind friend or two were not wanting in addition to furnish him with a few tools and necessaries to complete what he had begun when a stripling, with so much success as an engineer, at the end of a hedge stake or broom stick. Of course for this primitive pediment of science was substituted a spindle as bright and sparkling, as his father said, as a lady's eyesight. And for the mutton bone and top of the old tin saucepan was substituted a circular piece of block tin, cut through and fashioned as shown.



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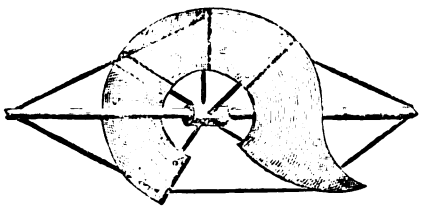
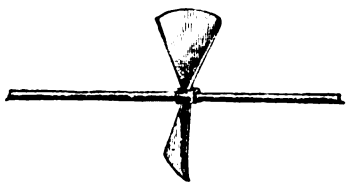
which when transversely twisted, thus,

and fixed on its axle, gave this next transfiguration of its economy :—



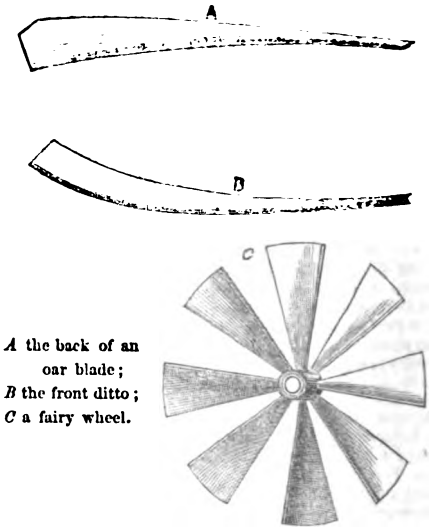
This prodigious effort of poor George's, though considered the best screw of the day, succeeded by Ericcson's which much resembled it, and the Smith's, Brown's, Jones', and Robinson's imitations of them being somewhat overlaid with science, inasmuch that it was not calculated to give motion until the completion of its first revolution, as well as to sustain the pressure of the ship's way at fifteen knots an hour, (which is calculated to be six tons on the point opposed to its resistance supposing its diameter twelve feet,) was soon set aside, as all screws ultimately will be, for the propeller, which George at first, as has been shown, started with. So without much ado, the old idea of the mop-stick came into vogue again, and forthwith grew out of it the following invention, the mutton bone, in a very great degree, serving as the pattern in the shape of a fan at an angle at 45° of its axial motion :—



After a world of hard labour, as he termed it, George, after boxing the compass of all the angles under the sun, and making the machine describe as many circles in an hour as gyrations are performed on a windy day, as the gardener said, by a cherry clapper, finding the principle of its action the correct one, at once sought out for the means to protect it in a patent, then requiring some hundreds of pounds to complete it. Of course, like many as good or better men before him under like circumstances, George's little castles in the air came to the ground for his want of capital, crushing his hopes in their fall as he saw rise from their ashes a hundred of his wealthy imitators, now many of them enjoying the proceeds and premiums of the wreck of the genius of the screw's sole inventor.

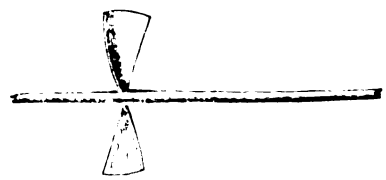
It is rather a remarkable feature in the imitations of the screws of George Blencowe, from the first which he had permission to try on the lake of Captain Trotter's park at Totteridge, in Hertfordshire, to that which he had perfected in 1832, now used with a trifling deviationfrom its original by the Great Eastern, none seem to have got the correct angle of 45° of their axial motion. And though science is indebted to Sir Howard Douglas for his animadversions on many similar faulty inventions, yet is but little additional knowledge to be gleaned about the screw in his little work on Naval Warfare,* replete as it is with great modesty and ability. There is one remark, however, about the disadvantageous position of the screw under the ship's counter deserving the greatest attention, not the less for its ever having been a point in debate amongst scientific men from its first invention, than for the stubborn perseverance in the present practice of its faulty situation. "From the position of the screw in an aperture close under the ship counter," as Sir Howard very justly remarks, "the water which is divided by the body of the ship subsequently flows obliquely towards the screw; and again, the water, after being pressed by the screw, is broken by the stern-post and rudder, where being arrested, part of it is forced forward in the direction of the ship's motion." Doubtless, this is a serious objection to the fair-play of the screw's action; and if the pressure of motion is as the cube of the screw's diameter, as much power of propulsion is lost as that back pressure retards it, particularly as the gyrations of an eddying volume of water act impulsively upon its revolutions. "Another objection to the screw in its present position of the vessel," continues Sir Howard, "is, that the shake of the screw, and the consequent injury to the stern of the ship, are caused by the sudden and violent reactions of the disturbed water in that place against the blades of the screw as they enter and emerge from thence." But the remedy proposed in rounding the fans of the screw, or whether they be angular or semicircular, does not appear fairly to meet the objection, since the stroke of its diameter must determine its force. To give this ingenious invention fairplay surely it is necessary to disentangle it of all such impediments (as described by Sir Howard). If at the stern of a vessel the plunging against the screw of the eddy and the disturbed current of the ship's way distracts its motion, surely there is a remedy at hand in fitting it to the bows of a ship before or after its cut-water, where the undisturbed action of the fluid's equal pressure would give a steadiness of motion irrespective of such fatal objections.

Whilst passing in review the subject of the screw, or more properly propeller (since it has no property in common with the former in the water than a figure of 8 has above it when cut out by a skater), a further and equally interesting anecdote of its invention, more recently than that just described, may not prove uninteresting to those who lean rather to sympathy with original genius than to a worship of the wealth accumulated by its practical application. To Mr. Farquhar, of Tower Hill, the eminent chronometer maker, be then the honour due in his own words, of the revival of its discovery. "Sir," said the old gentleman, after hearing the errand, and measuring his inquirer's mental stature under the deep and thoughtful brows of a northern head that had won its mechanical immortality—"Sir," continued he, "your introduction by my friend is your welcome. Sit down, Sir. Well, now you must know, Sir, taking the morning air as I usually did thirty years since over the drawbridge of the London Docks, my attention was arrested by a youth about twelve years of age propelling, or sculling, as it is called, a boat by its stern in a manner so unusual as to excite my unbounded curiosity, and to venture in me a thought of its transference to circular motion. Ever delighted at improvement—for our countrymen never throw a chance of advantage away, as you southerns good-humouredly say, honestly acquired—I was at once delighted and instructed, and the lad and I were the best friends in the world long after; he for the value to me of his skiff, and I to him of the means of earning an honest penny. It was no little trial, to one like myself, of six feet stature, unable to swim, and burly withal, as you may suppose, Sir, when the tide at times ran wildly, to adjourn with him to the deep-water of the Lea, there to abide the rocking to and fro of his little cockle-shell, not more than double my length, and of such slender proportions as to require my holding on its gunwales with a tenacity and grip with which you know, Sir, my countrymen, in common with all, ever hold their own with. However, giving the lad a fair price for his lesson, my best wits, after putting together and pulling to pieces as many bits of tin, models of little ships, some with holes at their sterns, and others with wells in their middles, as would fill a garret, and coupling what I had learnt of the skiff's motion with that of a fairy wheel, which as children we all have delighted in during windy weather, as it skims along the ground like the flue of the heather, made out in the rough the following models :—



A the back of an oar blade;
B the front ditto;
C a fairy wheel.

Now you see, Sir," continued the animated old gentleman, "by reducing the fans to a pair, twisting them inversely at an angle of 45° of each other, and inserting them at the end of a split stick, thus,



and then through a tube to my clockwork in the boat, my screw as my heart seemed to respond to its motion spun away my model after the following fashion, from one side to the other of the creek, as true as a water-rat" :—

A public exhibition of this taking place, of course the same fate befell it as its predecessor by Blencowe, as the following statement will exhibit, printed about the time of the award of a premium for the screw's discovery to certain capitalists, and to the patentee of a very similar screw, indeed, by a gentleman :—

"*Statement of William Farquhar, the real Inventor of the Universal Under-water Propeller, claimed and patented by Lieutenant Carpenter.*

"If the government of this country, of whatever party, had not shown invariable disposition to do justice to individuals, however obscure, who had a clear and dispassionate case to present, the undersigned would hesitate to solicit attention to this statement. If a right could cease to be a right, because he was had it lacked means to bring it under the notice of those influential to recognise it, the writer of this statement would despair of the justice he now seeks.

"In 1828 (so far back as this date) I, the undersigned, William Farquhar, was in the employ of Mr. Grant Preston, a relative, a well-known inventor, to whom the navy owes the Ship Deck Lights still in use. The constant talk of naval improvements going on in that society first turned my mind to inventions, of which in my time I have perfected several. Standing one day in the London Docks on one of the swing-bridges, I noticed under me a man scudding a boat, when it instantly occurred to me that the oblique action of the oar could be produced by wheel-work. I went home, and found three persons (two of whom are now living) and proposed the thing to them.

*"On Naval Warfare," p. 37. Murray, London, 1858.

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They were all persons that had considerable influence in such matters; but, as it frequently happens in these cases, my proposition was received so coldly as to deter me from prosecuting the design I had formed—the design now understood to be Lieutenant Carpenter's. It was not until 1833-4 that circumstances induced me to recur to the aforesaid idea, and then an event occurred that gave a clear proof of its superiority to any other plan. At that time I was employed to make a piece of machinery for driving a model boat, the patent of Mr. W. Hale. The party for whom it was made disagreed with Mr. Hale, and a law-suit ensued; when I, to show him who lost his money in the matter that he had lost nothing, made a model of my aforesaid invention, which answered beyond my expectation. From that time up to 1839, I kept showing it to everybody I thought capable of understanding it. Many nautical men in the navy, and engineers, and practical workmen saw it, many of whom (some have since deceased) I am ready to produce in proof thereof. As, however, I had no means of applying my invention, I was naturally disheartened. At the end of 1838, or early in 1839, I was invited by the captain of a large steamer to inspect a model of a similar invention, exhibited in a public room in Gracechurch-street. Here I first met Lieutenant Carpenter, who had himself a model of a gun brig with him, which Admiral Sir Arthur Farquhar (at that time in the room) had declared utterly fruitless. Lieutenant Carpenter was disheartened, and took his model to a side table. I followed him, and pointed out to him exactly what was wanted; and my idea of the Universal Underwater Propeller* was exactly what he shortly after patented, and nearly in the very words I had used: though at this conversation he said, 'the idea (the plan I described to him) had never entered his mind;' these were his exact words. I afterwards showed my invention at the Polytechnic by the special desire of Admiral Sir Arthur Farquhar: and on that occasion I established my priority to the invention in Lieutenant Carpenter's presence. Persons, at that time when he took his patent, commonly remarked that the invention was mine. I have had no means adequate to the establishment of my right to it, but I have never ceased publicly and privately to assert my claim to it; and now that Government are about to reward the actual inventor, I respectfully pray for a committee of inquiry into the real origin of the aforesaid invention, and to be examined with my witnesses upon it. I offered my invention to the Admiralty before ever meeting Lieutenant Carpenter.

"Fully aware that few things are more perplexing and disagreeable than to decide among rival claims of inventors—positive, dogmatic, impatient, antagonistic, often urging their claims with the heat of a monomania—the aversion to listen to them I know is very great, and I am not very sanguine of success on this account. Still somebody, after all, is the real inventor in all cases, and justice should be done to him for the sake of scientific progress. In this belief I beg permission to submit my statement to your friendly consideration.

"WILLIAM FARQUHAR,
"10 King-street, Tower-hill, London."

"May, 1855."

"COPY OF PETITION BY THE AUTHOR OF THE STATEMENT.

"*To the Honourable the Commons of Great Britain in Parliament assembled.*

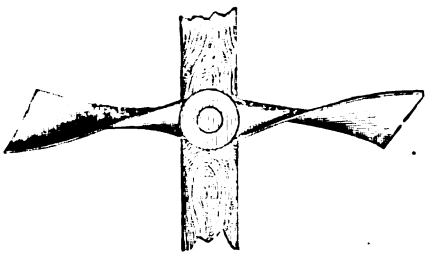
"The humble petition of William Farquhar, of No. 10 King-street, Tower-hill, London, showeth:—

"That your petitioner was the inventor of the propeller used in the navy and other vessels for underwater propulsion, of which propeller your petitioner made a working model in 1834. That your petitioner showed the invention during a period of five years, and offered it to many persons whom he thought capable of appreciating its value, but with little success.

"At length your petitioner having met in a public room in Gracechurch-street Lieutenant Carpenter, your petitioner described his invention to him. The said Lieutenant Carpenter took out a patent for the same invention a few weeks afterwards. These facts your petitioner can clearly establish, and he earnestly and respectfully prays your honourable house to institute an inquiry into the real original of the aforesaid invention, and cause your petitioner to be examined thereupon.

"And your petitioner will ever pray."

Perhaps the following idea of the fans set at angles of 45° of each other, and coming as nearly as possible to the original models, might serve as a hint for improvement, particularly if it can ease the fluid upon the screw's axis, which the present one in use is far from effecting.



But its proper place, let it be borne in mind, as before hinted, is foreward, as sailors say; for who would fix the sails behind instead of before the windmill?

With such facts before us, can it be surprising, Gentlemen, that men of genius, without the means of promoting their inventions, are so much preyed upon by capitalists, dividing amongst them at least the £15,000 awarded by Government? Whatever may be said to the contrary by shrewd calculators looking on rags as they cull its fruits for their own advantage, there can be no question that science is ever the sufferer, as the scores of discarded screws will prove by such conduct, as well as the inventors. And there is no mistake so fatal to the advancement of genius, as that made when premiums without inquiry are injudiciously awarded (as in this case of the two gentlemen referred to), to bustling unscrupulous men of business, having the ear of State interest, and eminently successful by assurance.

I have the honour to be, Gentlemen,
Your obedient servant,
W. DE ST. CROIX.

Grove-end, Highgate, 15th Oct., 1859.

* "Inventions of this nature are properly called 'Screw Propellers,' but as no part of a screw is employed in the successful invention adopted in the Navy, I adhere to my original plan, which is nearest the mechanical truth."

IRON SHIPBUILDING.

A MANCHESTER correspondent writes the following letter:—Among the many and mighty inventions and adaptations which have contributed to make this country and this age famous, a conspicuous place must be given to the application of iron to shipbuilding. Without it England's mercantile marine could scarcely have kept pace with the marvellous growth of her commerce, and oceanic steam navigation would yet have been in its infancy. Even Brunel's genius would have quailed in attempting the construction of the Great Ship in any other material; and it is scarcely too much to say that the abundance and richness of the furruginous ores which are found in this island, and the facilities for their reduction placed to our hands by nature, compelled our naval constructors to direct their attention to the use of manufactured iron in building vessels.

The iron ship, when well built, is indeed stronger, safer, and more durable than any other and yet if we search the records of those disasters to which all seagoing ships are exposed it will be found that the most destructive and appalling have occurred in iron bottoms. I need only call to mind the wreck of the Birkenhead, which will find a place in history as the scene where the disciplined bravery and devotion of our soldiers were nowhere more conspicuously displayed, and that awful and heartrending catastrophe which within the last few days has carried sorrow and anguish into hundreds of homes. Yes, while the hearts of relatives are yet bleeding, and the public is stunned with the immensity and suddenness of its loss; while many would try to bury their grief in oblivion, and others would prefer to contemplate in silence such an illustration of the mysterious end of Providence, I conceive that the lessons which the loss of the Royal Charter is calculated to afford ought not to be overlooked, and that the causes of a wreck so sudden and so complete should be most promptly and searchingly investigated.

I would, therefore, very earnestly and very prominently bring under the notice of your readers certain general features and practices in the construction of iron vessels which in my opinion are in the last degree dangerous and reprehensible. It would seem to commend itself to the common sense of every man that in building an iron sailing or steamship which is to be subjected to all the strains and buffetings of tempest-tossed seas, which will be freighted with hundreds of human beings and the most precious cargoes, and which must run the risks of collisions and strandings, none other than the very best and strongest materials should be employed. The toughest iron, the best seasoned spars, and the stoutest planks and ropes should alone find places in such a venture. But in our ordinary every-day practice is this the case? Is not any kind of iron thought good enough to build a ship with? What is the meaning of "boat plates" being the lowest priced in any ironmaker's list? If we pay £25 or £30 a ton for the plates of which a locomotive boiler is made, why should we give only £8 10s. or £9 per ton for those of which a ship is built? If safety can only be bought at the high price in the one case, are we not courting disaster with the low price in the other? Who will draw the fine line of distinction in moral responsibility between the directors of a railway company who should take your fare, place you in a comfortable first-class carriage, and drive you at 40 miles an hour over a viaduct which was miserably insecure, and the owners of vessels who send passengers to sea in ships sheathed with plates which are as brittle as glass? The only answer to this question in the way of excuse is, I fear, that most men are really and truly ignorant of the facts. In the eyes of the merchant in London or Liverpool who orders the building of a ship, iron is iron. He probably does not know that in this material there are as many shades of quality as there are in the wines or fruits which all bear one common name; and yet I am within the mark when I say that he might by paying £2 or £3 per ton increased price upon the plates forming the outward sheathing of his ship immensely increase the vessel's strength and durability.

With good well-worked plates, where the fibre of the iron is ductible and tenacious, and where these plates are well and judiciously fastened together, no vessel, even if wrecked in such a gale as that of last Tuesday, would break to pieces so suddenly and so utterly as the Royal Charter seems to have done.

But built of the "boat plates" of the present day God help the human freight of the ship that strikes upon the rocky shore!

I would therefore advise shipowners when contracting for new vessels, instead of being satisfied with a specification which provides good ordinary "boat plates" to be used, and which are, in fact, about the most rubbishing quality of iron which is made, to insist that the sheathing should all be of best, or double-worked quality. In a vessel of 1,000 tons it would not increase the cost 500*l.*, and the value is gained in the greater strength and durability of the ship, and to say nothing of the lives that it may possibly save.

Further, I would caution all well-disposed shipowners to look with great suspicion upon the cheap offers which are constantly laid before them as temptations to order ships. To any one conversant with a ship's value, what other construction can be put upon a contract for a vessel of 1,000 tons with the most expensive outfit, for 13*l.*, or 13*l.* 10*s.*, or even 14*l.* per ton measurement ready for sea than that the builder means to employ bad materials and scamp his work? He begins upon such an order with a determination either to cheat his customer or cheat his creditors. But such vessels are built on the Clyde, the Tyne, and elsewhere, and I maintain that the shipowner in buying them shares with the builder the moral responsibility of a great guiltiness, for they are deliberately launched and freighted to go to the bottom.

I am, &c.,
Your faithful servant,
AMICUS.

Manchester, Oct. 31.

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IRON STEAM-SHIPS.

THE following remarks on iron steam-ships, by Mr. W. Litchfield, deserve consideration:—"The awful catastrophe of the loss of the Royal Charter, and her speedy breaking up on the rocks in Molfre Bay, has recalled to my mind certain discoveries which have of late been made by the officials of Her Majesty's Dockyard at Portsmouth in relation to iron vessels, which I think cannot be too widely known, and may possibly have some connection with the speedy breaking up of the Royal Charter. Iron steam-vessels have arrived home from foreign stations to a certain extent leaky, and after being paid off and cleared out have been taken in hand for the necessary repairs. On the insides of the vessel's plates being examined it has invariably been found that the whole of the rivet heads, where the wash of the bilge-water reached, had been worn off as cleanly as if cut by a hammer and chisel. This has lead to a composition or cement being used over the surface of the plates of sufficient thickness to raise the surface of the plate to an equality with the head of the rivet, and in some cases bricks have been laid on the top of this cement, thus presenting a smooth surface to the wash of the bilge-water, and preventing its action on the heads of the rivets. In every case where this has been tried, the results have been perfectly successful, the heads of the rivets, after considerable service, being as sound as the first day they were made. On the contrary, where the rivets have not been protected, but left to the action of the water and grit, in every case have the heads of the rivets been destroyed, and with nothing to prevent their falling out the first severe strain the vessel should meet with at sea. Her Majesty's troop-ship Magara, now in the steam-basin at Portsmouth, and lately returned home from foreign service, is an illustration of what I have stated, and thousands of rivets are now in her bottom which can be knocked out by a common punch from the inside. The plates of the Royal Charter may have been protected in a manner that would preserve their fastenings, or they may not have been. The fact could very easily be ascertained, and its importance will, I trust, be sufficient excuse for my addressing you on the subject."

STEAM TOWAGE ON CANALS.

THE following letter relates to Mr. Spence's paper on Robertson's Chain Propeller published in our last number:—

Sir,—In your *Journal* (of the Society of Arts) of the 30th ult. is an article describing an invention by Mr. W. Robertson, of Strangeways, Manchester for the traction of barges on canals, and an experiment said to have been made on the Bridgewater Canal. The paragraph states that various attempts have been made to employ upon canals steam-tugs propelled by paddles or screws, in place of traction by horses, and says the objection against them is always the same—that the waves created by the propelling surface injure the banks, &c. It then proceeds to describe the invention, and concludes by saying that the experiments proved highly satisfactory.

In the first place, the experiment can hardly be considered satisfactory when there is a loss of 25 per cent. in drawing an empty canal-boat: but the chief objection is, that the difficulty of steam traction for canals is not fairly stated. That the waves created by the propelling surfaces injure the banks, when the screw is used, is simply untrue. The injury to the banks is caused by the increased speed of the vessels, which, in a narrow canal, lowers the water when each boat is passing about eighteen inches, and the sudden return of this does the injury complained of. When the speed is less than four miles an hour it is not observable, but beyond this the injurious effect is very apparent, without any perceptible wave from the action of the screw.

Some years since an experiment was made on the canal between Wigan and Liverpool, in the presence of several of the directors of the canal and large coal-owners who wished to economise the carriage of coals. A long, narrow screw-steamer was employed, and it drew a long train of laden coal-barges, diminishing the number at intervals. It was found that, whilst the amount of load made comparatively little difference in the power of traction, the injury to the banks was solely caused by the rate of speed, which it was not safe to increase beyond a horse's walk. Nothing, therefore, was to be gained in speed, and even if the employment of a steam-tug to draw a long train of barges were less costly than the employment of horses, there still remained the difficulty of passing the locks, which would prove so serious a diminution from the saving on level water that the attempt was abandoned.

There is nothing in the account of the experiments on the Bridgewater Canal which shows that either of the difficulties I have alluded to has been overcome, or even so great an advantage gained as that by the screw-steamer. I am, &c.,

BARNETT BLAKE.

Leeds, Oct. 11, 1859.

PATENT LAW.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—The question of the patent law is always unfairly argued; if talent is to be protected as a stimulant to exertion, why is one description of talent, literature, to be protected for twenty-one years at a mere nominal charge, a few copies of the work, which is attended with no greater outlay than the price of a few quires of paper on which the manuscript is written, while the mechanician in many cases must expend large, aye, enormous sums, in making and remaking models and experiments, to be repeated afterwards on a large scale, and even then, however successful he may be, though he attain the most valuable results, if its adoption depend on Government officials or public companies, he may apply to them in vain—insult will be his only recompense, as he will, to a certainty, be treated with silent contempt, even though the sacrifice of human life depends upon their decision. And here is a case in point. Numerous lives have been needlessly sacrificed at railway stations through travellers entering or quitting the carriages while in motion, for which there is not a shadow of excuse, because I could easily and effectually prevent a repetition of those fearful scenes; and yet on three different occasions I immediately wrote to the chairman of the company, stating that it could easily and cheaply be avoided, when they showed such a brutal indifference to the excruciating agonies of their victims that, will it be believed, they did not even deign me a reply! The same with shipwrecks on our coast, the greater number of which I could, to a certainty prevent; but official indifference heartlessly consigns them, their crews and passengers, to destruction. The plan I suggest, and no one could justly complain of such an arrangement, is a per-centage on the article supplied, when he, the patentee, would only pay in proportion to his gains, and at the close of, say the seventh year, he might then be justly required to purchase a renewal of his term, if just it be, or even politic, to tax science while literature is free!

J. C. DE LA FONS.

13 Carlton Hill, St. John's Wood.

CONCUSSION AND PERCUSSION SHELLS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—In reference to my communication on the above heading in your number for last week, I beg to add that the different inventors or projectors of percussion and concussion shells were allowed to have a trial of their respective shells on board the Excellent, at Portsmouth. Captain Moorsom, R.N., then lieutenant, was the gunnery officer when the experiments were made; the plan of each projector was kept *secret* from all but the captain commanding and Lieutenant Moorsom After a time, when the different reports were made to the Admiralty, a shell called the Moorsom percussion shell was adopted, and kept a profound *secret*. Its construction is now generally known. There was an error in the date of Colonel Beamish's letter to the editor of the *United Service Magazine*; it should have been of August, 1852, and not 1859.

I am, yours obediently,

J. NORTON.

Rosherville, 31st October.

THE STELLA LAMP.

THIS lamp, patented in 1857 by Mr. James Broad, of 150 Drury-lane, posse-ses several features of interest which renders it worthy of the attention of those to whom a cheap light is of consequence. In this category may be, of course, included the whole race of economic housekeepers, and for that class it may be of service to add that it is of great brilliancy, and that the "Stella" oil prepared for it is safe, clean, and healthy. This Stella oil, indeed, appears to us to be of greater importance than the lamp itself, although there are curious mechanical features in the lamp—and also in the method of applying the wick, which is new, and extremely simple. Stella oil will not light like camphine or naphtha, and other dangerous substances now used for burning, and hence one great element of its harmless nature, to which is added the fact of the absence of odour when not inflamed (for then there is none) being of a healthful character. Nor does it evaporate, freeze, corrode, or thicken, but on the contrary, as far as experience goes, it keeps its liquid character intact throughout all temperatures. It, moreover, lights very quickly, and the result of experiment shows a saving of one half over colza oil. We may have more to say of it after longer acquaintance.

THE INTENDED NEW COPPER OR BRONZE COINAGE.

It is known that the Government intend to issue a new coinage of a bronze alloy, to replace the existing copper coinage; and we may now state that the arrangements have advanced so far that in Manchester there have been constructed the engines to drive the stamping presses to be used, and also the boilers needed for that purpose. The engines and boilers have been made by Messrs. R. Ormerod and Son, of the St. George's Ironworks, Chester-road, Hulme. The latter have already been forwarded to their destination, and the former will follow next week. That destination is the works of Messrs. H. Heaton and Sons, of Birmingham, who have, we are told, executed all the copper coins struck for this country for many years, and who also successfully competed for the execution of the new French currency issued by Napoleon III. The pair of engines are upon an improved direct action principle, and of 50 horses' power; some patented arrangements of Mr. W. B. Johnson (who is connected with Messrs. Ormerod's establishment) being introduced. The frames are vertical instead of horizontal; it being supposed that strength and some other advantages are thus gained. The cylinders are of 20 inches diameter, the stroke being 4 feet. The fly-wheel has a diameter of 18 feet and weighs 13 tons; and the engines being intended to make from 36 to 40 revolutions a minute, the wheel will be speeded to 60 revolutions. The power will be given off from the axle, close to the fly-wheel, so that little or no checking strain should fall upon the engines. But as the metal to be used for the new coinage will be very much harder than copper, and as in striking coins from the latter metal the resistance will sometimes check, and even stop, the machinery, there have been special appliances added to these engines, which, by means of levers, will enable wheels to be slipped and the engines in effect thrown out of gear, while other levers will enable the working arrangement to be gradually and easily restored. The engines are beautifully finished. The two boilers are each 25 feet long and 5 feet 6 inches in diameter; with a 2 feet 9 inch circular flue, fitted for firing at each end, so as to secure more rapid production of steam, and an almost complete burning of smoke. The steam pressure is to be 60lb. It is estimated that two

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or three years, at least, will be needed for getting in and replacing the existing copper coinage.—*Manchester Guardian.*

SIR HOWARD DOUGLAS'S SCREW PROPELLER.

WE are requested to support the remarks already made by ourselves on this subject by the following "Opinion on Sir Howard Douglas's claim to the Invention of the Improved Screw Propeller," which is identical with the opinion already expressed in our article on page 194 of our number for September 23, 1859:—

"I have very carefully examined into the claim made by General Sir Howard Douglas in regard to his being the first to devise the screw propeller blade of the particular form shown and described at page 61 of his work on 'Naval Warfare with Steam.' This propeller blade consists in a modification of the Admiralty screw propeller, each blade of which was formerly made of about one-sixth of a helix or complete screw, with the forward or leading edge, and also the after edge, perpendicular to the shaft, consequently, such a blade increased in width the further it proceeded from the axis, and was widest at its outermost edge or periphery.

"Sir Howard Douglas, as I understand his claim, alters this propeller blade in respect to its leading or forward edge only; and he does so by removing parts of such forward edge, so that, in place of its being a straight line, he makes it into a convex curved line; and he leaves the after edge of the blade as heretofore.

"If the above be the correct expression of Sir Howard Douglas's claim, I am clearly of opinion that he was the first to devise and publish that particular form of screw propeller; and I am further of opinion that, whatever be the advantages which may arise from the use of that propeller blade, to Sir Howard Douglas will be due the merit of having originated it.

"I am intimately acquainted with Mr. Griffiths' screw propeller blades; and I can only imagine that that gentleman, when he wrote the letter to the *Times* newspaper on the 30th August last, was uninformed of the precise nature of Sir Howard Douglas's claim, or he would not have fallen into the error of supposing that Sir Howard Douglas claimed his (Mr. Griffiths') previous invention. It is of the essence of Mr. Griffiths' invention and of his patent, that screw propeller blades should become 'narrower or tapered towards their outside extremities, in contradistinction to the form hitherto adopted of increasing the width of that part of the blade.' Now, Sir Howard Douglas's propeller blade does go on increasing in width as it proceeds outward from the axis, and it is widest at the periphery; consequently, his blade is the reverse of that invented by Mr. Griffiths.

"I would further state that the giving a convex curved form to the forward or leading edge of a screw propeller was not new either to Sir Howard Douglas or to Mr. Griffiths; Lowe and others having used and published descriptions of screw propeller blades with curved forward or leading edges; but these propellers differed in other respects both from those of Mr. Griffiths and also from those of Sir Howard Douglas.

"(Signed) WILLIAM CARPMAEL,
"24 Southampton-buildings.
"27th September, 1859.

LIST OF NEW BOOKS.

Beale's Illustrations to "How to Work with Microscope," 1s. 6d.
Engg. Met., Rankine, on the Steam-Engine, 12s. 6d.
Euclid's Elements, Books 1-6, by Playfair, 11th edit., by Kelland, 5s.
Fresenius's Qualitative Chemical Analyses, 5th edit., by Bullock, 9s.
Journal of Royal Engineers in Crimea, by Elphinstone, 4 vols., 84s.
King's Study-Book of Mediæval Architecture and Art, Vol. II., 3s.
Marshall's Index Ready Reckoner, for Wages, 2nd edit., 3s.
Page's Handbook of Geological Terms and Geology, 6s.
Robinson's Treatise on Optics, 10s. 6d.
Pepper's Boys' Play-book of Science, illustrated, 6s.

The splendid show of chrysanthemums in the two Temple Gardens are now open to the public (free) every day from nine till dusk. Visitors are respectfully invited to an inspection of the extraordinary collection of pompones, a dwarf variety of this beautiful autumn flower, in the garden of the Middle Temple; the entrance to this garden is from the broad flight of steps in front of the fountain, within a few minutes' walk of the larger garden, and near Essex street.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance.* Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements

To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

OUR APPEAL.

WE have to express to several gentlemen the earnest and grateful thanks of the person referred to in the appeal made at page 284 of our last number. To her thanks we would add our own, for the prompt and efficient aid which several of our readers and friends have responded to our statement. Among the sums already received are the following:—J. L., £4; L., £2; R., £2; H. C., £2; T. S., £1 1s.; C., £1; B. N. and Co., 10s. 6d.; P. P., 10s.; W., 10s.; H. A. G., 10s.; S. L. T., 10s.; J. N., 10s.; B., 5s.; T. L., 5s.; T. B. D., 5s.; J. G., 5s.; J. P., 2s. 6d.; Anon (Norwich), 2s. We shall have others to announce next week—we hope many others.

Our Weekly Gossip.

Mr. John Macgregor, of the Temple, Barrister-at-law, has published the following memoranda in the Journal of the Society of Arts:—"In the matter of the broken bell at Westminster, perhaps we might possibly learn from the Russians what is to be done in making a better job of the next casting. Every person knows how celebrated Russia is for the size, the tone, and the numbers of its church bells. Some weeks ago I was at Kimra, a small town on the Volga, in the centre of Russia. Part of the church tower had been lately consumed by fire, and the bell had fallen from a height of fifty feet, and embedded its edge about two feet in the stone pavement below. This bell weighs more than sixteen tons, that is, it is two tons heavier than the Westminster bell, yet it survived this fall, and is still sound, without even a crack. Let us bring this bell to London, and let it toll the time until the clockmakers settle their squabbles, and a better Big Ben is cast." We must add, we do not think it necessary to go to Russia for enlightenment on this question, nor need we wait "until the clockmakers settle their squabbles," because "clockmakers" have no squabbles to settle. The one thing to be done is to get the matter out of Mr. E. B. Denison's meddling hands, then all things will probably go rightly.

The same gentleman in the same place says:—"Mr. J. W. Carlile calls attention to the large quantity of sawdust and wood-cuttings wasted or burned without effective purpose. This is an important subject, when we consider the enormous heaps of sawdust found near timber-works in Europe and America, the danger from fire if they are left near the mills, the expense of carting them to a distance, the valuable space they occupy, the destruction of fish caused by casting the sawdust into the rivers, and the trouble of burning this material to avoid these disadvantages. I was much struck with this when passing through Sweden last week; and it occurs to me that it may be well to mention that I saw a boiler-furnace burning crude sawdust, entirely unprepared and unmixed, in successful operation last summer, at St. John's, New Brunswick. I do not recollect exactly the construction of this furnace, but I think that Mr. J. Robinson, the proprietor of the extensive saw-mills where it is used, would gladly send a description to any person who may apply for it." Mr. Macgregor deserves thanks for these suggestions.

Captain Norton writes:—"I beg leave to enclose the copy of a letter from the Count Stuart d'Albini, on the subject of my gossamer cartridge, samples of which I had the pleasure of leaving at your office on the 24th instant.—

"'Dear Sir,—I have the pleasure to acknowledge your obliging letter, and the gratifying samples of your admirable and valuable cartridges. I thank you very much for the opportunity of judging of them by inspection. I perceive at once all their value, and appreciate entirely their admirable ingenuity, efficiency, and simplicity. Their practical operation in the field will be of the highest value, and ought immediately and generally to supersede the use of any other hitherto introduced. I shall not fail to bear testimony to their pre-eminence, and beg of you to receive the sentiments of high esteem and consideration with which I am, yours very faithfully,

"'THE COUNT STUART D'ALBINI.

"'11 Duchess-road, Egbaston, Birmingham, Oct. 25,

"'Captain Norton.'

"N.B.—Many years ago I made what is called the skin cartridge, but found it liable to decompose and rot. All varnishes to prevent damp are worse than useless, as they clog the interior of the barrel.—J.N."

Dr. McCormack, of Belfast, writes:—"The natural and pardonable solicitude of the country on the subject of the national defences, has suggested to me the practicability and desirability of a description of steam floating batteries, of shallow draught, but of great beam, carrying heavy breach-loading ordnance—vastly superior, I conceive, to any in hand, or hitherto proposed. Compartments should be introduced, along with every expedient calculated to ensure strength and safety. The upper or weather deck should be arched somewhat, and otherwise bomb-proof: the sides heavily plated with wrought iron plates; the ends pointed; the rudder and steering apparatus, with the high-pressure locomotive engines, so arranged as to permit the vessel to steer either way with equal facility, the paddles or screws working within a groove in the vessel's bottom. Watson's ventilators would insure a supply of air; bull's-eyes set in the deck, and plate-glass sliding panes covering the ports or embrasures, when the vessel was not in action, would yield light; otherwise, the ports should be covered with folding iron shutters, equally strong with the vessel's sides, to be closed at night, or in heavy weather and during action, only opening in full when the guns were run out for discharge. At night, the electric light would shed a brilliant light on the surrounding darkness, while, at the same time, it might be obscured on the side of danger, or even extinguished at pleasure. These batteries would act *à fleur d' eau*, or at the water level, the most efficient position of any; they would be on the watch day and night, and at all hours. By having a sufficient number, the crews of men and boys would not be unduly harassed by too prolonged duty. As the present coast-guard, as at present arranged, would be no longer needed, the men comprising it would go far to man the boats on duty As the crews might spend half their time on shore, the men would not be too long separated from their families. They would be efficiently trained to the use of heavy ordnance; and as the rafts or floating batteries, by telegraphic signals, could be concentrated on the point or points of danger, the result, I submit, would be an infinite improvement on the heavy, lumbering, inefficient ships of war on which we now alone too much depend, while a degree of security would be realised for our shores, not neglecting other effective measures, that might well bid defiance to open force or wily snare on the part of any opponent or opponents whatsoever."

The following note is curious:—

12 Newport Street, L Square, 1859.

GENTLEMEN,—Will you be kind enough to accept the following supposition? I believe that I have found out the means to take respiration under water, and that I can remain any time I like; and also that the water will not affect any part of the body of the diver,—similar to the invention which enables a man to walk through a flame of fire without receiving hurt. I intend to put it to the test, which if it answers to my idea, without doubt it will be beneficial to the divers. I spoke to Mr. Heincke of the Polytechnic Institution yesterday on the subject.

Your obedient servant,

LAURO CECCONI.

An old subscriber may fairly have space for the following letter:—

Elm Cottage, Oct. 28, 1859.

GENTLEMEN.—I have just read in August 19, 1859, No. of your Magazine p. 113, middle column, from the bottom 13 lines, that many officers "are inclined to recommend a recurrence to the old paddle wheel." I have taken the MECHANICS' MAGAZINE from the very first number. I have for many years frequently set forth what I consider a desirable alteration; that is, placing the paddle wheels amidships under an air-tight case, the float board working between an inner and outer bottom of the ship. Some of the first engineers in the kingdom have pronounced the principle sound if it could be reduced to practice. It occurred to me a few days ago, when on board the Great Eastern, that to fill a large a space as the two paddle wheels would occupy, with compressed air of sufficient elastic force to resist

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a column of water from the load line to the inner bottom would take a large air pump, and consequently require great engine power; to obviate this it occurred to me that the paddle boards might be fixed to an air-tight drum, such as proposed by Captain Selwyn to pay out the Atlantic cable, and that this would so limit the space in the paddle case, that a comparatively small air-pump would be required. If the plan is feasible, the motive power would be free from all danger from fouling, or shot, and the point of propulsion would be near the centre of gravity, and do away with much of the unpleasant vibratory motion felt in paddle ships. Yours most obediently,

C. P. BANKS.

Tickets of admission to the public to view the Franklin relics at the United Service Institution will be issued this week for Monday, Tuesday, and Saturday in next week and the weeks following, in limited numbers, as the accommodation that can be furnished by the institution is inadequate to meet a large number of visitors. The tickets are to be obtained from Stanford, Charing-cross; Graves, Pall-mall; Mitchell, Charing-cross; Parker, West Strand; Potter, Poultry; and Byefield, Charing-cross.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 800, 805, 821.
BOILERS AND THEIR FURNACES, &c., 806, 812.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., *None.*
SHIPS AND BOATS, including their fittings, 798, 807, 822.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 797, 804.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 803, 811, 814.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 802.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 810.
LIGHTING, HEATING, AND VENTILATING, 823.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., *None.*
METALS, including apparatus for their manufacture, 826.
CHEMISTRY AND PHOTOGRAPHY, 799, 819.
ELECTRICAL APPARATUS. *None.*
WARFARE, 798.
LETTER PRESS PRINTING &c. *None.*
MISCELLANEOUS, 801, 807, 808, 809, 813, 815, 816, 817, 818, 820, 824, 825.

797. J. CARTWRIGHT. "An improved implement for crushing clods and pulverising the surface soil, also convertible into a press wheel roller." Dated March 30, 1859.

The patentee claims the use of the rings or sections with serrated or saw-formed teeth, and the concentric rings, whether used separately or in combination with each other, as well as the method of converting the implement into a press wheel roller by reversing the frame and shafts. *Patent completed.*

798. C. P. COLES. "An apparatus for defending guns and gunners in ships of war, gun-boats, and land batteries." Dated March 30, 1859.

This consists of a large convex shield covered with thick metal, and mounted upon a platform which is capable of revolving and which carries the gun or guns. Apertures are formed in the shield to allow the muzzles of the guns to pass through. *Patent completed.*

799. W. GOSSAGE. "Improvements in the manufacture of certain alkaline silicates, and in the production therefrom of liquor silicis or liquid flint." Dated March 30, 1859.

This consists, 1, in using carbonate of potash, which has been previously deprived of sulphate of potash or sulphate of soda, and thereby obtaining soluble glass of such quality that the solution or "liquid flint" produced from it is free or nearly free from alkaline sulphuret. 2. In purifying liquid flint made from soluble glass, so as to destroy such alkaline sulphuret as may be present therein. The inventor effects such purification by means of oxidising agents. *Patent abandoned.*

800. A. V. NEWTON. "An improved governor for marine and other steam-engines." (A communication.) Dated March 30, 1859.

This consists in the use of a small steam-engine working independently of the engine whose speed is to be governed, the same being so applied as to drive certain mechanism which effects an unvarying resistance to its motion, and is combined with mechanism driven by the engine to be governed, the whole being so arranged as to work a regulating valve which controls the supply of steam to the last-named engine. *Patent completed.*

801. W. SMITH and E. SMITH. "Improvements in means or apparatus for the purpose of regulating the flow or passage of fluids." Dated March 30, 1859.

This relates to cocks in which the closing of the passage is aided by the pressure of the fluid acting upon a valve. The valve is formed at its inner surface somewhat egg-shaped, and it is recessed on the opposite surface to receive and form a sort of rim round the india-rubber packing, which is thereby prevented from spreading. The stem of the valve passes through a hole formed for it in the case of the cock or tap, where it may have a head to open it, or be connected to a lever formed and weighted to aid the closing of the valve. There are modifications included. *Patent completed.*

802. J. LACY, S. SIMPSON, and H. SMITH. "Certain improvements in machinery for preparing and spinning cotton and other fibrous materials." Dated March 31, 1859.

This particularly applies to roving frames and to mules and throstles, and consists in unwinding the bobbins by rollers, or other friction surfaces, to avoid the strain on the fibrous material, and to effect a uniform delivery of the slubbings or rovings. *Patent completed.*

803. C. PICKERING. "Improved apparatus for brewing." Dated March 31, 1859.

This relates to a portable apparatus for brewing. It is proposed, 1, to make the copper case fluted or corrugated, to hold fire clay or cement. 2. To make the mashing tun square; also to form a chamber round the mashing tun into which hot liquor is to be admitted for maintaining the heat of the wort. Also to adopt a novel arrangement of gear to the mashing tun. 3. To make the cooler in two parts. 4. To make the circulating channels or conduits of corrugated metal. 5. To fit the working squares or "gyle-tuns" in the mechanical agitators; also the balm separator to separate the yeast from the beer. *Patent abandoned.*

804. R. C. ROSS. "Improved apparatus for cultivating soil." Dated March 31, 1859.

Under one modification, the digging or cultivating details are carried upon a simple rectangular frame or carriage mounted upon wheels, and arranged so as to be drawn by horses or ropes. The digging mechanism is of the rotatory kind, a series of digging blades or forks being mounted upon a revolving drum or frame, which is driven by a strap or otherwise from one of the axles of the supporting wheels. *Patent abandoned.*

805. T. IVORY. "Improvements in rotary engines." Dated March 31, 1859.

This consists, 1, in causing the impelling fluid while admitted at the circumference, to act directly on an area near the centre of the circle of revolution, and in so arranging the parts of an impulse rotary engine as to produce this effect. 2. In an arrangement for working expansively the steam, or other elastic fluid. 3. In adapting and applying to rotary engines in which a solid piston is made to travel within a steam channel, the arrangements appertaining to the first and second heads of the invention. 4. In adapting and applying the same arrangements to the recoil engines described in a previous patent, dated 30th July, 1857. 5. In obtaining an increased effect from the motive fluid in engines on the "Barker's mill" principle by the arrangements above alluded to. 6. In obtaining the expansive rise of elastic fluids in impulse rotary engines, by means of a hollow arm or chamber opening into a steam channel at the circumference. *Patent completed.*

806. T. IVORY. "Improvements in steam-boilers, and furnaces for the same." Dated March 31, 1859.

This invention comprises various features. We cannot quote the specification at sufficient length for an intelligible abstract. *Patent completed.*

807. A. MORTON. "Improvements in sextants or quadrants for nautical purposes, and which are also adapted to the measuring of altitudes or angular distances." Dated March 31, 1859.

The object here is simplicity of construction, and adaptation of parts of instruments for measuring altitudes or angular distances. The measuring of angular distances between any two objects may be obtained by the use of a single reflector. The rays are only once reflected, though several reflectors may at the same time be employed. *Patent completed.*

808. D. B. WHITE. "An improved indicating gauge-lead, or plummet." Dated March 31, 1859.

This consists in a particular construction of, and adaptation to, a cord or line for sounding, whereby the depth of the bed or bottom may be ascertained by the formation of an electric signal when the plummet reaches the bottom. *Patent abandoned.*

809. J. S. BATESON. "Improvements in generating steam, and in apparatus employed therein." Dated March 31, 1859.

This relates to a former patent, dated 30th December, 1858. The invention comprises various modifications, and is not fully described apart from the drawings. *Patent completed.*

810. F. MORTON. "Improvements in the construction of fences, and the posts or pillars for the same, parts of which improvements are also applicable to the construction of gate posts or poles for telegraph purposes, or for signal posts." Dated March 31, 1859.

This relates more particularly to the construction of strained fences, and the object of this part of the invention is to draw the strands, cords, wires, &c., up to tension, and to keep them tightly strained, and also to allow of their being slackened with facility. This the patentee effects by passing the strands, cords, wires, &c., through rollers, barrels, or pulleys, provided with any contrivance whereby rotary motion may be communicated to them. *Patent completed.*

811. W. E. NEWTON. "Improvements in mills for cleaning rice." (A communication.) Dated March 31, 1859.

This relates to a mill composed principally of a pestle and mortar, and consists in attaching the pestle to a rod which passes through the bottom of the mortar containing the rice. To this rod a reciprocating motion is imparted in a vertical direction, power being applied from a crank to the rod, which extends through the bottom and projects below the mortar. *Patent completed.*

812. A. V. NEWTON. "Improvements in the construction of steam boiler and other furnaces. (A communication.) Dated March 31, 1859.

This consists, 1, in constructing the curve next the fire chamber forming one part of the reverberatory combustion chambers, by continuing it upward and towards the opposite curve which extends towards it in a curve of increased radius, so as to cause the two curves, enclosing in part the combustion chamber, to terminate in their overhanging projections in such relation to each other as to ensure a more perfect rotation or eddying of the gases and other products from the fire-chamber in the combustion chamber, and thus enable them to mix intimately with the air admitted to the combustion chamber. The gases thus mixed will be so presented to the incoming current of flame as to ensure their complete combustion. 2. In forming the curves of metal protected from the extreme heat of the fire-chamber by an additional segmental or curved plate which shall form a heating chamber (having a horizontal orifice above) for heating the air before passing into the combustion chamber. *Patent completed.*

813. D. K. CLARK. "Feed-water heating apparatus." Dated April 1, 1859.

The patentee claims a method of heating the feed-water of steam boilers by the introduction of the water in one or more currents or jets, into one or more confined channels, and the injection of one or more jets of steam from the exhaust or otherwise into the same passages in immediate contact with the water, so as forcibly to impinge upon, and to draw, suck, or project the water through the passages, and to immediately disperse and intermix with it on the way, thereby effecting the immediate condensation of the whole or part of the steam, and consequently the heating of the water within the passages. *Patent completed.*

814. F. P. A. AUBURTIN. "An improved preparation of food for herbivorous animals." Dated April 1, 1859.

This consists, 1, in the application of mucilage of the cactus opuntius in combination with chopped hay, straw, lucern, bruised oats, barley, or other grain or seeds usually employed in the preparation of food for horses. *Patent completed.*

815. I. SIGISMUND. "Certain improvements in the manufacture of artificial teeth, and in the apparatus connected therewith." (Partly a communication.) Dated April 1, 1859.

The inventor uses the tusk of the morse or walrus in the manufacture of artificial teeth. *Patent abandoned*

816. R A. BROOMAN. "Improvements in machinery for solidifying, pressing, and moulding." (A communication.) Dated April 1, 1859.

This relates to a previous patent, dated April 14, 1857, and consists in driving plungers forward directly

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by means of an excentric, which subsequently draws them back again. The plunger rods are formed with protails, orjections, which enter and are guided by grooves in a plate round the central shaft. This plate is cut away at intervals to allow of the parts most subjected to friction being lubricated. *Patent abandoned.*

817. R. A. BROOMAN. "A new preparation of indigo for dyeing." (A communication.) Dated April 1, 1859.

This new preparation is obtained by treating indigo with alkaline earths partly saturated with such acids as sulphurous, phosphorus, cyanhydrous. *Patent abandoned.*

818. W. E. NEWTON. "Improvements in cricket bats." (A communication). Dated April 1, 1859.

This consists in constructing the blade of the bat with a mere shell of wood, and a filling of cork or other elastic material, and in constructing the handle of a hollow tube of wood, with a strip of whalebone, or other flexible or elastic material running through the centre and down into the blade. *Patent completed.*

819. W. E. NEWTON. "An improved process of manufacturing sulphate of lead, carbonate of lead, nitrate of potash, and sulphate of soda." (A communication.) Dated April 1, 1859.

This consists, 1, in dissolving the lead in acetic or nitric acids, and in decomposing the soluble nitrate, or acetate thus formed by means of sulphuric acid, by which an insoluble precipitate of sulphate of lead is formed, the nitric or acetic acids being set free to be used in dissolving another portion of the lead. 2. In decomposing the sulphate of lead, as above obtained, by means of carbonate of potash, and nitrate of soda, whereby are obtained carbonate of lead, nitrate of potash, and sulphate of soda. *Patent completed.*

820. J. J. DAVIS. "An improved pad, applicable for inking, damping, and other like purposes by hand." Dated April 1, 1859.

This relates to the application of a pad mounted on an axis so that it can be turned to present different surfaces, as may be required for the inking or colouring of stamping surfaces, and for damping or gumming stamps, envelopes, &c., by hand. *Patent abandoned.*

821. W. TOD. "Improvements in marine steam engines." Dated April 1, 1859.

This comprises a variety of detail to which we cannot here give space. *Patent completed.*

822. Y. THOMAS. "An improved propeller for ships, vessels, boats, and water wheels." Dated April 1, 1859.

This invention is not described apart from the drawings. *Patent completed.*

823. J. DESMET-SEAUT. "An improved gas-burning and lighting apparatus." Dated April 2, 1859.

This consists in a peculiar arrangement of apparatus having rotatory burners, suitable for ordinary and ornamental gas-lighting purposes. The apparatus consists of a closed cup or vessel of glass, or other suitable material, within which a recipient is fixed containing water for purifying the gas on its passage through openings in a supply pipe, to a rotating pipe, which is partly immersed in water; this latter pipe turns on a pivot and is caused to rotate by the pressure of the gas on its passage through it, and communicates such rotatory motion to the branches or burners in communication with it, and which may be in a spiral or other form. *Patent abandoned.*

824. A. RIPLY and J. ROBERTS. "Improvements in machinery for striking or scraping leather and tanned or untanned hides." Dated April 2, 1859.

The main object of this invention is the production of a machine which will approach as near as possible the action of the hand—that is, to give to the knives which act upon the hide a direct backward and forward horizontal motion over the surface of it, and at the same time a motion of rotation on their edges in a plane nearly at right angles to the former, and by means of these compounded motions to excel the effects produced by the knife when guided by the hand. The patentees produce three distinct motions within the knife or knives, two of these motions may be said to result from effects transferred to the knives, the third, from the action within them, the resultant of the whole three being the twisting or oscillating motion before alluded to. *Patent completed.*

825. J. HALL and J. S. SPARKES. "An improved application of machinery for the purpose of hoisting, lowering, pulling, or drawing weights." Dated April 2, 1859.

This consists in the application of what is called in mechanics' the endless screw in combination with the wheel and axle to crabs, cranes, windlasses, and that class of machines. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Aug. 29, 1859.

1968. R. Besley. Improvements in machinery for printing and for numbering and perforating documents. (A communication.)

Dated Sept. 13, 1859.

2084. W. B. Adams. Improvements in the permanent way of railways.

Dated Sept. 21, 1859.

2146. G. K. Geyelin. Improvements in machinery for making solid, hollow, and perforated bricks, also tiles, drain and socket pipes.

2150. G. D. Robinson. Improvements in apparatus for regulating the pressure of gas and other fluids.

Dated Sept. 26, 1859.

2176. R. Kay. Improvements in preparing and bleaching textile fabrics and materials, and in the machinery or apparatus employed therein.

Dated Sept. 28, 1859.

2196. J. F. Stanford. An improved apparatus for giving warmth to the lower extremities and members of invalids and others when travelling, or in churches, chapels, theatres, rooms, carriages, and other similar places, and on ship-board, and also for airing carriages.

Dated Sept. 29, 1859.

2204. T. Allan. Improvements in applying electricity for telegraphic purposes, and in apparatus employed therein.

Dated Sept. 30, 1859.

2214. E. Sonneborn. An improvement in the manufacture of cement.

Dated Oct. 1, 1859.

2230. J. Baughan. Improvements in the manufacture of soap.

Dated Oct. 3, 1859.

2236. R. A. Brooman. Improvements in treating clay, and in the manufacture of bricks, tiles, and other like articles, and in machinery employed therein. (A communication.)

Dated Oct. 5, 1859.

2252. F. J. Dove. Iron clasped bonding plates for joints and other building purposes.

2256. W. G. S. Mockford. Improvements in the manufacture of starch.

2260. T. H. Dodd. Improvements in portable apparatuses for the use of smiths, carpenters, and other workmen.

2262. W. E. Newton. Improvements in blankets used for printing calicoes and other fabrics, and in the mode of washing or cleaning the same. (A communication.)

2264. J. Prichard. Improvements in spurs.

2266. J. Webster. An improved construction of spring for carriages and other purposes.

2268. J. Turpie. Improvements in the fore and aft gaff and boom sails of ships.

2270. G. Long and J. Archer. Improvements in the manufacture of manure.

Dated Oct. 6, 1859.

2272. J. P. and E. Scott. An improved instrument for boring and drilling. (A communication.)

2276. E. O. Tindall. Improvements in machinery or apparatus for crushing or reducing grain, seeds, and other substances.

2278. A. M. Ferry. Improvements in the manufacture or production of oil, and in lamps for burning the same.

2280. A. Hind and J. Lowenthal. Improvements in the manufacture of pottery and china wares. (A communication.)

2282. R. Warry. Improvements in breech-loading ordnance, and in projectiles for the same.

2284. G. and J. Gibson. Improved machinery for raising and removing soil or earth from sewers and other excavations.

Dated Oct. 7, 1859.

2286. W. Brookes. Improvements in securing the tyres of railway carriage and engine wheels. (A communication.)

Dated Oct. 8, 1859.

2290. W. Dawson and T. Singleton. Improvements in apparatus applicable to looms for weaving.

2292. J. H. Johnson. Improvements in the treatment of fatty matter. (A communication.)

2294. P. Robertson. Improvements in preparing, boiling, and fermenting worts, and in maturing beer, spirits, and cyder.

2296. H. Monument and G. Berry. Improvements in apparatus for raising and moving earth, and other matters and bodies.

Dated Oct. 10, 1859.

2297. J. S. Parfitt. A registering nautical velocimeter, for measuring the speed of ships, and also of currents of water.

2299. C. A. Shaw. Improvements in machinery for shaping or bending tinned sheet iron, and other sheet metal. (A communication.)

2300. T. and J. Knowles and A. Rigg. Improvements in machinery or apparatus for shaping, cutting, punching, and drilling metals, which improvements are also applicable to presses.

2301. G. White. Improvements in frames for spinning and twisting yarn of any description of textile materials. (A communication.)

2303. S. B. Parker. A method of, and apparatus for, revivifying oxide of iron and other agents for purifying gas containing metallic particles.

2304. W. Martin, jun. An improved method of damping linen and other textile fabrics.

Dated Oct. 11, 1859.

2305. L. J. Jeannin. A new system of pumps.

2306. C. F. Beyer. Improvements in machinery for boring and drilling.

2307. J. L. Tenting. Improvements in the construction of buffers for railway and other carriages, also applicable to other purposes where springs are employed.

2308. J. L. Tenting. Improvements in the construction of the axles of railway and other carriages.

2309. J. Earl. Improvements in arranging and applying harness to the draft of carriages.

2310. W. D. Hart. Improvements in pressure regulating apparatus for gas burners.

2311. J. Smith. Improvements in breech-loading fire-arms and ordnance.

2312. P. G. Cunningham. Improvements in the construction of artificial teeth and gums.

2313. A. Whytock. Improvements in coating sheets of metal with other metals and other substances.

2314. A. V. Newton. An improved mode of clarifying and defecating saccharine solutions and juices. (A communication.)

2315. F. A. Lohage. An improved construction of water-wheel. (A communication.)

Dated Oct. 12, 1859.

2316. J. Skertchly. Improvements in the manufacture of mosaic and other ornamental tiles and slabs, and in apparatus connected therewith.

2317. G. Scott. Improvements in generating elastic fluids and in the apparatus for that purpose.

2318. W. Day. A direct-action rotary steam-engine.

2319. A. A D. Hely. Certain improvements in the manufacture of tobacco for smoking purposes.

2320. J. Carrick. Improvements in commodes, water-closets, and other sanitary appliances.

2321. Z. Nuttall. Improvements in looms for weaving.

2322. J. Thomson. An improved form of hydraulic valve and apparatus to be used in the manufacture of gas.

2323. T. Rothwell. Improvements applicable to warehouses and other buildings in which "well-holes" are constructed for the purposes of light and ventilation.

2324. E. H. Baron, J. Wheater, and L. Tatley. Certain improvements in carding engines for carding cotton, wool, and other fibrous materials.

2325. J. Tangye. A new or improved method of actuating certain kinds of motive power engines, and in the distribution of motive power.

2326. E. H. Taylor. Improvements in apparatus applicable to the permanent-way of railways.

2327. C. H. Southall. An improved apparatus for making and finishing boots and shoes.

2328. C. P. Moody. A method of, and apparatus for, raising grass and other crops on to stacks, which apparatus is also applicable to raising and transferring weights.

2329. T. B. Daft. Improvements in flexible valves.

2330. H. Bright. Improvements in machinery or apparatus for navigating the air.

2331. T. Twells. Improvements in machinery and apparatus connected therewith for embroidering or ornamenting woven, looped, or laced fabrics.

Dated Oct. 13, 1859.

2333. J. Rhone. An indicating meter tap.

2335. J. Hunter. Improvements in machinery or apparatus for ploughing or cultivating land.

2337. L. H. Rousseau. Improvements in steam engines.

Dated Oct. 14, 1859.

2341. F. Levick. An improvement or improvements in the manufacture of iron.

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2345. J. Jack. Certain improvements in steam engines and boilers for marine and land purposes.
2347. T. Robinson. Improvements in annealing or softening wire.

Dated Oct. 15, 1859.

2349. W. E. Newton. An improvement in the mode of applying india-rubber, gutta percha, or other elastic substances to give elasticity between the tires or outer rims and the hubs or naves of railway or other wheels and between other metallic bodies. (A communication.)
2351. F. A. Leigh. Improvements in machinery or apparatus for the manufacture of screws, bolts, and nuts. (A communication.)
2353. R. Bates. Improvements in engines for carding cotton and other fibrous substances. (A communication.)
2355. J. Echard. Improvements in machines and apparatus for ploughing and sowing. (A communication.)
2357. J. H. Brown. Improvements in the preparation of gunpowder for loading ordnance and fire arms.

Dated Oct. 17, 1859.

2361. G. Berry. Improvements in the construction of glass and earthenware vessels for containing fluids, particularly such vessels as are intended to contain fluids which may exert dynamic force on the stoppers of such vessels.
2363. L. Vidie. Improvements in transmitting the motion of steam engines.
2365. G. W. Reynolds and E. Dance. A new or improved manufacture of baskets and other articles usually made of wicker work, and new or improved machinery to be employed in the said manufacture.
2367. W. E. Newton. Improvements in preserving and disinfecting organic substances. (A communication.)
2369. J. Bernard. Improvements in the manufacture or production of boots and shoes, and other coverings for the feet, and in the machinery, apparatus, and means connected with such manufacture.
2371. D. Jones. Improvements in self-acting breaks to be used on railways.
2373. W. Hall and A. Wells. Improvements in the manufacture of ropes and cords.

Dated Oct. 18, 1859.

2375. G. Canouil. Cartridges' paper, chemically prepared for percussion fire-arms.
2377. J. Reynolds. Improvements in the manufacture of wrought nails. (A communication.)
2379. G. T. Bousfield. Improvements in machinery for steering vessels. (A communication.)
2381. C. Hill. An improved fastening for stays and other purposes.
2383. W. E. Newton. An improved method of making combs or gills employed in the preparation of fibrous substances. (A communication.)
2385. A. Scheurer-Rott. The preparation of certain substances for fixing colours in dyeing and printing, and for other purposes.

Dated Oct. 19, 1859.

2387. G. Worssam. An improvement in non-condensing steam-engines.
2389. J. Gordon. Improvements in machinery or apparatus for pulping coffee.
2391. T. Spencer. Improvements in the manufacture of carbonate of soda.
2393. C. Cowper. Improvements in photographing on uneven surfaces, and in apparatus for that purpose. (A communication.)
2395. J. J. Bowen. Improvements in manufacturing the pots for containing liquids used by publicans and others.
2397. W. Warne, J. A. Jaques, and J. A. Fanshawe. Improvements in the manufacture of elastic hoops or bands and other analogous elastic articles, applicable to various parts of ladies' and gentlemen's wearing apparel, and in the machinery employed in such manufacture.
2399. J. R. Palmer. Improvements in the manufacture of printing ink and paints and varnishes, and also in the manufacture of lacquers, japans, and blacking.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

2413. J. Avery. Improvements in railroad weigh-locks and other platform scales. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Nov.* 1, 1859.)

1463. C. F. Vasserot. Stereoscopes. (A communication.)
1487. A. P. How. Distilling apparatus.
1492. J. Meikle. Coating ships with asphalte.
1499. A. Barclay. Steam hammers.
1504. W. Russell. Wheels.
1514. H. Doulton. Jars and bottles.
1517. J. Mills. Keys and gibs.
1524. T. Howard. Condensing steam.
1526. C. W. Williams. Steam boilers.
1531. W. Coppin. Raising weights and bodies.
1534. D. J. Fleetwood. Shaping metals.
1535. B. Burton. Fire-arms.
1550. G. Chapman. Knitting machines.
1554. A. Gueyton. Enamelling.
1557. R. A. Brooman. Lithographic presses. (A communication.)
1562. J. A. Wilkinson. Printing presses.
1564. J. Bernard. Boots and shoes.
1574. R. Royds and A. Harcourt. Composition for protecting structures of iron.
1583. C. H. G. Williams. Dyeing.
1586. J. Simon. Composition to replace lead, &c.
1701. H. Parent. Looms.
1712. G. Welch. Frames for mirrors, &c.
1733. J. King. Distillation of spirits.
1895. R. A. Brooman. Locks and keys. (A communication.)
2038. E. R. Dann and E. Goldschmidt. Bonnet fronts.
2112. J. Beck. Stereoscopes.
2166. J. Gedge. Stamp holder and cutter. (A communication.)
2199. M. L. J. Lavater. Injection bottles.
2214. E. Sonneborn. Cement.
2276. E. O. Tindall. Crushing grain, &c.
2278. A. M. Ferry. Oil and lamps.
2309. J. Earl. Harness.
2331. T. Twells. Embroidering.
2363. L. Vidie. Steam engines.
2371. D. Jones. Railway breaks.
2377. J. Reynolds. Wrought nails. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Oct. 27, 1859.

1053. G. Pearson.
1058. R. J. Laing.
1061. T. Lacey.
1068. N. Libotte.
1069. N. J. Holmes.
1070. E. Lardenois.
1071. T. Clarke.
1072. J. Wheat.
1076. W. Corbett and W. Carmont.
1077. J. W. Welch.
1081. T. Smith.
1082. W. Winstanley and J. Kelly.
1084. J. Darlington.
1085. E. Francis.
1087. W. Clark.
1091. J. Souquière.
1092. T. H. Arrowsmith.
1095. W. Bavliss.
1096. R. A. Brooman.
1097. J. Basford.
1101. W. Gossage.
1103. F. W. Emerson.
1106. T. W. Miller.
1107. W. Clark.
1114. E. W. Seale.
1115. R. Mushet.
1116. W. H. Kingston.
1123. J. F. Allender and D. Rowley.
1140. S. Wright.
1145. G. T. Bousfield.
1148. A. C. Bamlett.
1149. M. Henry.
1150. R. Mushet.
1151. R. Mushet.
1157. J. Ramsbottom.
1174. M. Henry.
1176. W. O. Bourne.
1185. W. Spence.
1188. J. B. Lyall and F. W. Campin.
1193. T. R. Oswald.
1223. J. Brown, jun.
1237. J. H. Johnson.
1239. J. Childs.
1242. R. Wilson.
1257. W. H. Perkin and M. Gray.
1305. W. H. Nevill.
1308. J. C. Bent.
1320. W. H. Graveley.
1327. E. Breffit.
1419. A. V. Newton.
1440. S. Levy.
1540. A. V. Newton.
1560. J. Lawson and S. Cotton.
1628. J. H. Johnson.
1661. J. Combs.
1731. W. E. Newton.
1742. J. Davies.
1812. W. R. Drake.
1836. J. Cannon.
1840. G. T. Bousfield.
1860. De la Rue and H. Muller.
1919. Hon. W. Talbot.
1930. T. Richardson.
1965. D. Todd.
2001. W. Brown, jun., and S. Bathgate.
2032. J. J. Sieber.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2527. W. S. Losh.
2530. J. Armstrong.
2539. T. C. Salt.
2541. T. S. Heuzell.
2547. J. T. Way.
2557. J. Lawson.
2569. J. C. Sinclair.
2578. S. Middleton.
2650. W. Clark.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

519. M. Fitzpatrick.
525. M. and M. Myers and W. Hill.
543. J. Norton.
552. G. Hattersley.
572. H. Brinsmead.
579. A. V. Newton.
710. J. Noble.
756. F. M. Jennings.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Oct. 28, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
709	0 11	739	0 10	750	0 10	761	1 9	772	1 10	779	0 5
726	0 9	740	0 10	753	0 10	765	0 5	774	0 3	782	0 3
727	0 10	741	0 3	754	2 3	767	0 7	775	0 3	783	0 5
728	1 7	747	0 9	755	0 3	768	1 9	776	0 3	785	0 3
735	0 6	748	0 7	759	0 3	771	0 9	777	0 3	787	0 9

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

ENGINE, *Kingston-upon-Hull.*—Construction and erection of an expansive condensing pumping engine, 85-in. cylinder, at their waterworks at Stoneferry, near Hull. A specification and drawing of Mr. R. A. Mumler, 73 Sowgate, Hull, to November 15th. Tenders to November 23rd, marked "Tender for Engine," Mr. Wells, town-clerk, Hull.

RAILWAY BUILDINGS, *Great Northern Railway.*—At King's Cross Station, extension of provender store, trellis bridge, and conversion of straw store into stables. Plans of Mr. W. M. Brydone, the company's engineer, at King's Cross; and the specification and form of tender on payment of 5s. Tenders sealed and marked "Tender for extension of provender store," must be lodged at Secretary's office, King's Cross station, on Tuesday, November 8th, when parties tendering must be in attendance.

RYDE PIER, *Isle of Wight.*—For the enlargement and improvement of the pier. Drawings, specifications, particulars, and forms of tender, Mr. W. C. Ratcliffe, solicitor to the directors of the pier company, to whom tenders, November 15.

WAGGON-WAY, *Newcastle-upon Tyne.*—For the excavation and other works required in the construction of a line of waggon-way for the Ayre's Quay Bottle Company. Plans, &c., 22 Bridge-street. Tenders, November 7th.

CHURCH, *Ripley, Derby.*—New tower, chancel, and vestry, extension of nave, &c., to the parish church of Ripley. Plans, Mr. R. Barber, architect, Eastwood, Nottingham, after November 28th. Tenders, December 17th.

CEMETERY, *Barnsley.*—For forming and stoning the roads and walks, and also laying out and performing the labour in planting, &c., at the cemetery at Barnsley. Drawings and specifications to Mr. W. H. Peacock, Clerk to the Burial Board, Church-street, Barnsley. Tenders to November 14th.

RESIDENCE, *Patersham, Surrey.*—For J. P. Musgrough, Esq. Specifications, &c., Mr. J. H. Fowler, architect, 32 Fleet-street, London.

HOUSES, *Shipley, Leeds.*—For the several works to be done in the erection of three houses to be built at Victoria Park, Shipley. Drawings, &c., at the office of Mr. S. Jackson, Kirkgate, Bradford. Tenders to November 7.

SURVEY, *Wortley, Leeds.*—For a new survey, plan, and valuation of the township. The plan to be on a scale of three chains to the inch. The township contains 1,036 acres, including about 2,000 dwelling houses. The overseers do not pledge themselves to take the lowest, or any tender. Tenders and testimonials for the above, or for a valuation without survey, may be sent to Mr. J. Stones, assistant overseer. Tenders to November 16.

SUPERINTENDENT OF PERMANENT WAY.—For the Punjaub Railway. Will be required to undergo a medical examination, and to proceed to India immediately. Salary £900 per annum. Apply by letter only, stating age, and enclosing copies of testimonials to T. A. Yarrow, Esq., consulting engineer, Gresham House, Old Broad-street, London, E.C.

MINING SECRETARY.—With influence, for a proposed company. Apply to M'Ewen and Glover, C. E., York Chambers, King-street, Manchester.

MECHANICAL DRAUGHTSMAN.—As an assistant to an engineer engaged on works in the country. Must have a good knowledge of accounts, and be able to prepare scale and working drawings from sketches. One who has been brought up in the work-shop preferred. Apply with all particulars, to T. W. W. Glynneath, Glamorganshire.

MILLWRIGHT.—For a forge and mill. He must be a thorough good workman, and one who may be fully relied upon to keep the works in repair. No one need apply who cannot produce good testimonials. Application to Mr. Parke, bookseller, High-street, Wolverhampton.

A MILLWRIGHT, AN ENGINE-FITTER, AND AN AGRICULTURAL IMPLEMENT-FITTER.—Apply to Mr. Mellard, Kent foundry, Rugeley, Staffordshire.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 11, 1859.

THE NEW SCREW LINE-OF-BATTLE SHIP VICTORIA.

THIS magnificent ship which will be launched on Saturday from Portsmouth Yard, in the presence of Her Majesty and the Royal family, deserves particular notice as being larger than any line-of-battle ship now afloat, and also as being the first three-decker that has been designed expressly as a screw-steamer. Her actual displacement when at her load-line will amount to very nearly 7,000 tons, which is greater than that of every other ship of war by nearly 1,000 tons!

We have at present afloat five screw three-deckers—the Marlborough, Royal Sovereign, Duke of Wellington, Royal Albert, and Royal George. These were originally designed for sailing ships; the first three by the late Surveyor of the Navy, Sir William Symonds; the Royal Albert by the late Mr. Oliver Lang. The Royal George was built on the lines of the old Caledonia, and was launched at Chatham in 1827. To adapt these vessels for the reception of the screw, they were altered as follows:—the Marlborough was lengthened in midships and at each end, and was also increased slightly in breadth; the Duke of Wellington and Royal Sovereign were lengthened in midships and by the stern; the Royal Albert was lengthened by the stern; and the Royal George only had the screw aperture cut in her deadwood, and was not lengthened at all.

The following table, showing the comparative principal dimensions of these ships and of the Victoria, will be found interesting to those of our readers who regard with satisfaction and pride any addition to the naval resources of the country:—

NAME.	Guns.	Horse Power.	Length between Perpendic.	Extreme Breadth.	Depth in Hold.	Burthen in Tons.
			ft. in.	ft. in.	ft. in.	
Royal George	102	100	205 7	54 6	23 2	2616
Royal Albert	121	500	232 9	61 0	24 2	3725
Duke of Wellington	131	700	240 6	60 1	24 8	3771
Royal Sovereign	131	800	240 6	60 0	24 8	3759
Marlborough	131	800	245 6	61 2	25 10	4100
Victoria	121	1000	260 0	60 0	26 10	4112

It will be observed that the Victoria, though larger than the Marlborough, does not carry so many guns. The armament of the Victoria is, however, the heavier of the two, as she carries on the middle and lower decks nothing but 68-pounders, as will be seen by the following table:—

	Ins.	Cwt.	Feet.	No.
Lower Deck	8	65	9 0	32
Middle Deck	8	65	9 0	30
Main Deck	32 prs.	56	9 6	32
Upper Deck	32 prs.	42	8 0	26
Do. do.	68 pr. pivot	95	10 0	1
		Total		121

The engines of the Victoria are by Messrs. Maudslay, Sons, and Field, and are of the nominal power of 1,000 horses.

The Duncan, 91, Prince of Wales, 131, and Royal Frederick, 91, all screw-ships, and building under roofs contiguous to that of the Victoria, are to be launched by the end of the present financial year.

The Royal Alfred, a 91-gun screw-ship, is to be laid down immediately on the slip vacated by the Victoria.

The Victoria's keel was laid in the early part of February, 1856. She has been, therefore, but three years and ten months building. We recently had the satisfaction of inspecting her, and in justice to Mr. Abethell, the Master-Shipwright of Portsmouth Dockyard, under whose superintendence she has been built, we must state that as a specimen of sound and careful shipbuilding the Victoria cannot be surpassed. As Her Majesty the Queen will attend the launch in person, it is generally expected that her appreciation of Mr. Abethell's services in this respect, and of his eminence as one of the foremost naval architects of the country, will be marked by Her Majesty conferring the honour of knighthood upon him on the occasion.

UNSINKABLE SHIPS.

WE have received from Mr. Atherton a lengthy communication respecting our last week's article on the above subject, in which we are requested to insert Mr. Atherton's "letter of the 11th ult. "in full as it appeared in the Society of Arts' "*Journal*." Why the request is made we cannot divine; nor can we comply with it, for we have no space to devote to matter which would convey nothing novel or interesting to our readers. Mr. Atherton in the letter on another page implies, it is true, that we have put a forced construction upon his statements, but as he makes no attempt to prove the implication he can have no claim upon us in the matter. We might also, we think fairly, decline to insert the communication now sent to us, for it throws but little light upon the questions which we submitted to Mr. Atherton's consideration; but, on the whole, we think it better to give it a place in our columns.

It will be seen that Mr. Atherton entirely admits the truthfulness of our suggestions on the necessity of making the light material of which he speaks fireproof. He is, however, less explicit on the other and more important question, viz., what the design of the unsinkable war ship is to be. We are really afraid he has taken no pains whatever to give a practicable form to his propositions even in his own mind. At the first glimpse of the difficulties which we pointed out he abandons, in point of fact, an important part of his proposals, for he now tells us that "the property of being unsinkable does not "necessarily imply that such vessels shall have "no stowage below the level of the load water "line which may be appropriated to machi-"nery." But the truth is, Mr. Atherton's first suggestion (made in January last) was that the ship should be, "up to the line of its load dis-"placement, a *solid* mass of material," and he has nowhere until now repudiated this part of his plan.

But we need not pursue these considerations at present. Mr. Atherton's fundamental idea may be a good one; indeed we have ourselves a presentiment that unsinkable war ships, at least for purposes of home defence, will one day be devised. But the difficulty of producing them will lie as much in giving form to a light material as in procuring such a material, and we are sorry to find that Mr. Atherton is unable to add anything to our knowledge on either point. Nevertheless, good may arise from the introduction of the subject to public attention, and on this ground Mr. Atherton deserves praise. If the Council of the Society of Arts can adopt any means of hastening the realization of Mr. Atherton's ideas, they too will earn the approbation of the public.

THE MAIN DRAINAGE OF THE METROPOLIS.

METROPOLITAN people are beginning to awake to a very alarming fact, viz., that the great main drainage scheme is a gigantic blunder. Readers of this Magazine will not be startled at this circumstance, because we have all along exposed the folly of pouring into our river a vast quantity of material which in water is mere pollution, but which on the land would be inexpressibly valuable. Just now there seems to be a strong disposition on the part of the public to see eye to eye with us in this matter.

In the *Nautical Magazine* for the present month—a journal in which we should scarcely have expected to find a discussion of this subject—we observe a paper by Captain Heckford, setting forth a plan which he has submitted to the Metropolitan Board of Works, as the fruit of twenty years' acquaintance with the rivers of India. Captain Heckford proposes to obtain about twenty-four tons of salt water per minute by means of steam machinery erected on the sea-coast near Brighton, (or any more convenient site,) and to lead this water up to the Thames by means of pipes laid along a line of railway, these pipes branching off into two heads, one in the vicinity of Chelsea Bridge, the other at Blackfriars Bridge. Thus a constant stream of salt water equal to one 6 miles long, 670 feet broad, and 2 feet deep, would be forced into the Thames every month. "I need not point out," says Captain Heckford "the properties of pure salt water when "brought into opposition with that now in the "river between Chelsea and Deptford, further "than that the salt water thus injected would "find its way to the bottom of the river, "thereby raising it, and consequently the sew-"age matter, to a higher level; and as the "course of the tide is stronger on the surface "than near the bottom, the putrid water now "in the river would constantly, though gradu-"ally, be carried out to sea, and the offensive "substance on the bed of the river would be "totally destroyed by its saline action." Captain Heckford also suggests that his system of pipes could be connected with all cesspools, closets, &c., and that by means of separate sewers the whole of the feeculent matter of the Metropolis might be carried off to any fixed place, and its properties as a fertilizing agent be preserved. The plan could also be applied, he says, to the cleansing of the docks (which materially help to keep the river in an offensive condition), and to supply the place of fresh water, where the latter could be dispensed with.

We advert to these proposals of Capt. Heckford, not for the purpose of discussing his plans—which have less of novelty attached to them than he probably supposes—but with the view of pointing out the expression of opinion which they have elicited from the editor of the *Nautical Magazine*, Captain Beecher, R.N. Having always, he says, been averse to making the Thames the great receptacle for the sewage of our Metropolis, and regretted that a more appropriate application of it has not been found than in the measures of the Board of Works for their great main drainage scheme, he is not sorry to record Captain Heckford's scheme in his pages, since this, at all events in the long run, would be productive of purity, while that of the Board of Works will be productive of impurity, and that to an alarming extent. The fact of a stream of sewage running into this river during the half of every ebb tide must inevitably occasion, he continues, a state of the water in it between the middle of Sea Reach and Barking that is fearful to contemplate. "We tremble," he says, "for the effects of

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"poisonous exhalations to which the crews of "those ships will be subject that will have to ride "out the ebb in that part of our river, and for "the unhappy inhabitants of its banks. To us it "seems to be bringing down upon them deli- "berate destruction. The ships, it is true, "can avoid it, by not staying at anchor in "in such a filthy element; but towns are "towns, and homes are not so easily shifted." Captain Beecher goes on to say that we must not be surprised hereafter to find that the port of London will see its shipping diminish in consequence, the owners finding some other port where the health of their crews will not be injured by the pestilential vapours which they would have to encounter on the Thames. Such are the opinions of an experienced naval man on this subject.

On the other hand, the present week has brought us the testimony of an enlightened agriculturist upon the question. Mr. Alderman Mechi, of Tiptree Hall, in a letter to the leading journal, says he considers it a public duty to direct attention to a danger of great magnitude which threatens British agriculture, and through it the nation at large—meaning the gradual but sure exhaustion of the soil of Great Britain by our new sanitary arrangements, "which permit the excrement (really the food) "of 15,000,000 people who inhabit our towns "and cities to flow wastefully into our rivers." The continuance of this suicidal practice must ultimately result, he says, in great calamities to our nation. Science has shown us that the land, to the depth at which it is ordinarily cultivated, contains but a limited and measureable quantity of the elements of our food; that these elements may be readily exhausted, and that they can only be profitably restored by the application of human and animal ordure such as we now waste. A century of abstraction without replacements has reduced the old and once fertile States of the American Union to comparative barrenness, and although by extensive purchases of guano, bones, and feeding stuffs, we are trying to mitigate the evil, we are warned by that great man Baron Liebig that these attempts are but as a drop compared with what we waste. By a false delicacy and a want of knowledge we have been accustomed to deprecate as indelicate the very mention of our *excreta*, but the stern requirements of a rapidly increasing population imperatively demand of us the only profitable and available means of providing food for the people. Increase of population would, but for our sewer system, bring with it increased means of production. Such has been the case in China, where the commercial value of human excrement has ever been most wisely appreciated and availed of. Of course our Boards of Health very properly consider their only duty is to cleanse our towns and cities. It is for our landlords and agriculturists to associate their will and means to convey to the land those precious streams which now exhaust our soil, contaminate our rivers, and impoverish our agriculturists, and those dependent upon them. It may be said we are producing more food than we used to do; no doubt we are, by enclosing wastes, removing trees and fences, cleaner and deeper cultivation, &c., but by these very means and by the application of stimulating substances we are more rapidly hastening the exhaustion of our country. A very large proportion of our population would be starved but for the enormous importations of foreign food.

This is the testimony of Mr. Mechi, and although it contains nothing more than we have many times said, it is desirable to repeat it here once more. Once more, also, we would reiterate Baron Liebig's words:—"In the year "1855—1856 above ten million cwt. of guano "were imported, of which the greater portion "remained in England. In the course of half- "a century above sixty million cwt. of bones "have been imported into that country, yet all "this mass of manure is not worth mentioning "when considered in relation to the arable sur- "face of Great Britain, and is but as a drop "when compared to the sea of human excre- "ments carried by the rivers to the ocean."

It often happens in English life that, in reference to some subjects, our only privileges are to pay and protest. This Metropolitan drainage question is an example of this kind of thing. The fewer our privileges, however, the more mindful we must be of them; hence these observations. Hence also the *Times*' tardy action in the matter. "Everybody must feel," the leading journal now tells us, "that it is folly "to waste a substance which is urgently "needed, and to pour prodigally into our own "rivers what, at a heavy cost, we go to South "America to fetch. . . . . We are burning the "candle at both ends. We are paying heavily "to lose what we can very ill spare." May we not yet hope to see our river unpolluted and our soil enriched with the waste of this Metropolis?

THE STUDY OF SCIENCE.

IT is well that we who have to deal daily with the rough applications of science to common life may sometimes raise ourselves to that higher sphere from which alone the greater revelations of science are visible. Frequent opportunities of doing this are afforded us. The inaugural addresses delivered at the annual meetings of our scientific societies—the Royal Society, the British Association for the Advancement of Science, and others—usually are made the occasions for comprehensive surveys of the whole physical universe, so far as it is at present known to us; and we, for our part, are always inspirited and rejoiced by the contemplations thus occasioned. In the address with which Sir David Brewster opened the winter session of Edinburgh University a few days since, we are furnished with so splendid a representation of the spectacle which the natural world presents to the mind of the man of science that we cannot fail to win the attention of our readers to it.

What are the subjects which the student of the natural sciences has to explore? Sir David eloquently answers,—Creations of boundless extent, displaying unlimited power, matchless wisdom, and overflowing beneficence, will at every step surround him. The infinitely great and the infinitely little will compete for his admiration. And in contemplating the great scheme of creation which these inquiries present to his mind, he will not overlook the almost superhuman power by which it has been developed. Fixed upon the pedestal of his native earth, and with no other instrument but the eye and the hand, the genius of man has penetrated the dark and distant recesses of time and space. The finite has comprehended the infinite. The being of a day has pierced backwards into primæval time, deciphering its subterranean monuments, and inditing its chronicle of countless ages. In the rugged court and shattered pavement of our globe he has detected those gigantic forces by which our seas and continents have changed places—by which our mountain ranges have emerged from the bed of the ocean—by which the gold and the silver, the coal, and the iron, and the lime have been thrown into the hands of man, as the materials of civilisation, and by which mighty cycles of animal and vegetable life have been enbalmed and entombed. In his astronomical studies, the earth on which he dwells will stand forth in space a suspended ball, taking its place as the smallest of the planets, and like them pursuing its appointed path—the arbiter of times and seasons. Beyond our planetary system, now extended by the discovery of Neptune to 3,000,000,000 miles from the sun, and throughout the vast expanse of the universe, the telescope will exhibit to him new suns and systems of worlds, infinite in number and variety, sustaining, doubtless, myriads of living beings, and presenting new spheres for the exercise of Divine power and beneficence.

But, it must be remembered, objects like these will not be beheld without deranging the thoughts of untutored minds. When first presented to a mind thirsting for knowledge they are apt to disturb its complacent equilibrium and unsettle its convictions. But, said Sir David to his hearers—Should this be the mental condition of any of you, be not alarmed for its results. This species of scepticism is the infant condition of the uncurbed and generous intellect. There can be no firm convictions where there have been no perplexities and doubts, and that faith which comes in the train of early scepticism will finally rest upon an immoveable foundation. Credulity, on the contrary, is the disease of feeble intellect and ill-regulated minds. Believing everything and investigating nothing, the mind accumulates errors till its overgrown faith overmasters its untutored reason. Such a facility of belief may, in some cases, claim the sympathy even of philosophy, but when it spurns the strict demands of inductive truth, and plants imagination at the door of the temple of science, it cannot be too severely reprobated or too sternly shunned. "In the present day, indeed, when "religion and philosophy are assuming such "novel aspects; when the mysterious in reve- "lation is subjected to the scrutiny of philoso- "phy, and philosophy herself straying into the "labyrinths of mysticism, and claiming kindred "with the supernatural; when the apostolic "simplicity of Christian worship is marred by "the glitter and the mummery of exploded "superstitions, it is necessary to warn you "against speculations morally and intellectually "degrading. In the blue heavens above, in the "smiling earth beneath, and in the social "world around, you will find full scope for the "exercise of your noblest faculties, and a field "ample enough for the widest range of inven- "tion and discovery. Science has never de- "rived any truth, nor art any invention, nor "religion any bulwark, nor humanity any boon, "from those presumptuous mystics who grovel "amidst nature's subverted laws, burrowing in "the caverns of the invisible world, and at- "tempting to storm the awful and impregnable "sanctuary of the future." This is true wisdom as well as true eloquence, whatever Dr. Cumming may think to the contrary.

A great inventor and discoverer himself, it was not to be supposed that Sir David Brewster would miss from his ken, in an address like this, the triumphs of the mechanical and useful arts. The advances which have recently been made in these arts, he tells us, have already begun to influence our social condition, and must affect still more deeply our systems of education. The knowledge which used to constitute a scholar and fit him for social and intellectual intercourse will not avail him under the present ascendancy of practical science. New and gigantic inventions mark almost every passing year—the colossal tubular bridge, conveying the monster train over an arm of the sea; the submarine cable, carrying the pulse of speech beneath 2,000 miles of ocean; the monster

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ship, freighted with thousands of lives; and the huge rifle gun, throwing its fatal charge across miles of earth or of ocean. New arts too, useful and ornamental, have sprung up luxuriantly around us. New powers of nature have been evoked, and man communicates with man across seas and continents, with more certainty and speed than if he had been endowed with the velocity of the racehorse or provided with the pinions of the eagle. Wherever we are, in short, art and science surround us. They have given birth to new and lucrative professions. Whatever we purpose to do they help us. In our houses they greet us with light and heat. When we travel we find them at every stage on land, and at every harbour on our shores. They stand beside our board by day, and beside our couch by night. To our thoughts they give the speed of lightning, and to our timepieces the punctuality of the sun; and, though they cannot provide us with the boasted lever of Archimedes to move the earth, or indicate the spot upon which we must stand could we do it, they have put into our hands tools of matchless power by which we can study the remotest worlds; and they have furnished us with an intellectual plummet by which we can sound the depths of the earth and count the cycles of its endurance. In his hour of presumption and ignorance man has tried to do more than this; but though he was not permitted to reach the heavens with his cloud-capt tower of stone, and has tried in vain to navigate the aërial ocean, it was given him to ascend into Empyrean by chains of thought which no lightning could destroy and no comet strike; and though he has not been allowed to grasp with an arm of flesh the products of other worlds, or tread upon the pavement of gigantic planets, he has been enabled to scan, with more than an eagle's eye, the mighty creations in the bosom of space—to march intellectually over the mosaics of sidereal systems, and to follow the adventurous Phaëton in a chariot which can never be overturned.

This is Sir David Brewster's language, not ours; we are content to repeat it, and commend it to our readers.

THE PATENT OFFICE LIBRARY.

WITH reference to our last week's article on the Great Seal Patent Office Library we are enabled to state that Mr. Edmunds, the Clerk to the Commissioners of Patents, avows himself most anxious to obtain a suitable Library for inventors and patentees, and is likewise desirous that this Library should occupy a central position in preference to any other. It appears that Mr. Gladstone, the Chancellor of the Exchequer, is responsible for the present suspension of the arrangements which were in progress in the earlier part of the year. It is only fair for us to state further that we find the land agency mentioned in the article referred to consists in nothing more than certain friendly offices confined to the transactions of a single estate. We offer these explanations with much satisfaction because we find in them ground for hoping that the Library which is so much needed will ere long be obtained. We need hardly tell our readers that this is our only desire and object in connection with this subject, and that we have no reason whatever for speaking of the gentleman beforementioned with anything but respect.

The trial of the new (French) field-pieces, to which the grooved principle has been applied, went off to the great satisfaction of all parties. The experiment took place in the exercise ground at Saint Maur. The distance allowed for trial was the enormous one of 2,000 metres—the target, consisting of a pole, surmounted by a little flag, was scarcely visible to the naked eye, and yet, in spite of the high wind, every shot told!—*Morning Star.*

Literature.

Ure's Dictionary of Arts, Manufactures, and Mines. New Edition. Chiefly re-written and greatly enlarged. Edited by ROBERT HUNT, F.R.S., F.S.S., Keeper of Mining Records. Illustrated with nearly two thousand Engravings on wood. Part. I. London: Longman, Green, Longman, and Roberts. 1859.

IT is with the greatest satisfaction that we receive the first part of a new edition of the late Dr. Ure's great work, and our satisfaction is heightened by an examination of its contents. Mr. Robert Hunt is exceedingly well fitted to be its general editor, and he has associated with him a staff of gentlemen thoroughly competent to help him with the details of his great undertaking. No one can know better than ourselves how invaluable Dr. Ure's volumes have been to manufacturers and men of science generally; but it must be acknowledged that of late years the progress of science had carried us beyond it in many respects, and a new edition, bringing its articles up to date, was greatly needed. The part before us proves that the need is being most satisfactorily supplied. The 192 pages of this part carry us only to the article "Artesian Wells," which was reached on the 87th page of the edition of 1853, so that the new matter is more than twice as voluminous as the old. This arises, to a great extent, from the introduction of entirely new articles; but it is mainly the result of the extension of the former articles with modern matter. Among the many new articles the more remarkable are 8 pages on Acidimetry, 2 on the Air-engine, 2½ on Algæ, 4 on Aluminium, 7½ on Chloride of Ammonium, and 2½ on the colouring material named Arnatto, Arnotto, or Annotto. Among the extended articles the principal are, that on Acetic Acid, which is extended from 12 to 19 pages, others on Alcohol and Alcoholometry, enlarged from 15 to 23 pages; on Aldehyde, from 7 lines to a page; on Alkali and Alkalimetry, from 13 to 18 pages; on Alloy, from 4 to 11 pages; on Alum, from 8¼ to 18 pages; on Amalgam, from 2 lines to a page; on Ammonia, from 1 to 10 pages; on Anchor, from 4 to 9 pages; on Aviline, from 10 lines to 2 pages; on Anthracite, from 20 lines to 3 pages; on Antimony, from 1 to 3½ pages; and on Arsenic and its compounds, from 4½ to 8 pages. We give these details to show the comprehensive manner in which the new edition is being revised. Nor is any expense being spared in the "getting up" of the new edition. The new woodcuts, which are numerous, are exceedingly well engraved, and both the paper and the type are superior to those of the '53 edition. We find great reason to believe also, from a careful examination of this part, that perfect impartiality will be observed in the new and the re-written articles. The chief editor himself, Mr. Hunt, has not scrupled, we observe, to remove from the article on Actinism passages complimentary to himself, which formerly appeared in it. Dr. Ure gave Mr. Hunt credit for being the first discoverer of the actinic principle. Mr. Hunt "remits" it—to use the French Emperor's term—to M. Berard. Again, in the article on Anchors we find a fair and honest account of the various improvements which have been proposed in anchors from time to time, and are not (for once) surfeited with intemperate praises of the Trotman anchor. Indeed, the writer candidly says:—"Although for convenience Trotman's anchor is, as we have already stated, largely used by the merchant steamers, we cannot but feel that the separation of the fluke from the shaft, although it may be in many cases unobjectionable, is attended with the risk that when, in an emergency, the anchor is required, the means of connection may be at fault." According to the announcement the work is to be completed in fourteen parts, forming three volumes; the intervals at which the parts are to appear are not stated—probably are not known, as they may be dependent upon the opportunities of some of the authors. Each part will, however, be most valuable in itself, and manufacturers and others will be glad to secure each as it appears.

Journal of a Voyage to Australia and round the World for Magnetical Research. By the Rev. W. SCORESBY, D.D, F.R.S., etc. Edited by ARCHIBALD SMITH, Esq., M.A., F.R.S., &c. London: Longman, Green, Longman, and Roberts. 1859.

THE disturbing influence which the magnetism of iron ships exerts upon their compasses has been illustrated by an amazing display of mathematical symbols, but until the establishment of the Liverpool Compass Committee in 1854 very little indeed was done in the way of experimental inquiry into this important subject. This committee, which has rendered valuable services in this respect, was to a great extent due to the labours of the late Dr. Scoresby, and for this, as well as for his own individual exertions, we owe him a great debt of gratitude. The latest and most distinguishing act which he performed in connection with this compass question was that of making the voyage to Australia and round the world of which we here have the narrative. The ship in which the voyage was made was the Royal Charter, of which little now remains but melancholy memories.

The volume before us comprises three parts. The first consists of an able paper from the pen of the editor, Mr. Archibald Smith, forming an introduction to Dr. Scoresby's remarks. In this introduction the editor sets forth the objects of Dr. Scoresby's inquiries, and then takes up and elucidates the nature of the differences which are well known to have existed between Dr. Scoresby and the Astronomer Royal, and which had reference chiefly to the mathematical, or, to speak more exactly, to the theoretical phases of the compass question. The second part consists of an elementary exposition of magnetical principles, and of the phenomena of magnetism and compass-action and disturbance in iron ships by the rev. doctor. The third part is the journal of the voyage.

In so far as the compass question itself is concerned we shall deal with the results of Dr. Scoresby's voyage in the Royal Charter at another time, and shall therefore avoid the discussion of them here. We must not omit, however, to express our sense of the great ability and admirable spirit manifested in the remarks of Mr. Archibald Smith. The question with which he had to deal was an intricate and difficult one, and therefore required thoroughly scientific treatment; having also been the subject of a warm controversy between the Astronomer Royal and Dr. Scoresby it required impartial as well as careful discussion. In neither respect has the editor failed. His paper, though short, is a very important one, and will have the effect of restricting future controversies, which must occur, to the considerations which are really the subject of dispute—a very necessary thing.

But the volume before us has an interest altogether apart from the question of the magnetism of iron ships. Strange as the assertion may appear, we have found more amusement in this book than in any other which we have read for a long time. Dr. Scoresby appears to have been one of those men who, while great upon some one subject, are small upon almost every other. In magnetical science, and indeed in some other branches of science also, he seems to have been a strong, clear, original thinker. But this volume abundantly proves that in ordinary matters he was of the Lilliputian type. His account of the manner in which he came to embark on board the Royal Charter, and of the arrangements connected with that proceeding, is full of tiny details which no man can peruse with gravity; and throughout the voyage we have glimpses of him which are enough "to shake the midriff of despair with laughter." Seven days after the ship had sailed from Liverpool (on her first voyage) she was found not only to be in bad trim, but also to admit water through her sides and decks with a most pernicious degree of freedom. The captain was sick, and in

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doubt whether it were well to put back or not; whereupon the rev. doctor gravely undertakes to "go below into all departments of the passengers," as he puts it, and then report to him the results of his "impressions." The examination occupied an hour—"an hour of the most painful solicitude and sympathy," and the doctor occupies more than a page with a narrative of what he saw—among other things, "wives, children, and young women wet throughout their dress up to the knees, without possibility of drying their petticoats, or benefit from shifting them." One "very interesting looking young person" was "reclining on her bed" in "this very condition," and so forth! In another place we are informed that when the passengers had nothing else to do they sat and chatted—a circumstance which our "doctor of divinity" puts on careful record! On another occasion he tells us that, the evening being warm, "most of the ladies sat upon deck under a cloudy canopy, lightly covered, and chiefly without bonnets." At another time he gives us to understand that, becoming pained at the absence of everything but flying fish, he had a bucket of water drawn from the sea for him; and he records in his journal that on taking up a portion in a glass he discovered "a variety of minute creatures" in it, "generally of the animalculæ size and kind." Again, on drawing near the equator the sun, of course, became nearly vertical; and as an illustration of the fact, the doctor tells us "that the shadows of the ladies, having on a popular wide-brimmed hat" [only conceive a shadow in a popular hat] "were represented by a circular disc," except where "the amply expanding dresses happened to distort the circle by spreading incidentally beyond it." On another page we find this entry:—"A cetaceous animal (which, however, I did not see) was observed at some distance to leeward." But we must not multiply illustrations of the worthy doctor's *quasi*-scientific jottings! Most of our readers will remember the "elderly gentleman of scientific attainments" who sat in his library writing a philosophical treatise, and who, in the agonies of composition, looked sometimes at the carpet, sometimes at the ceiling, and sometimes at the wall; and when neither carpet, ceiling, nor wall afforded the requisite degree of inspiration, looked out of the window at the very time when Mr. Pickwick happened to be blazing away with his dark lantern in a certain back garden at the interview between his friend Winkle and the lovely Arabella. The scientific gentleman saw most brilliant lights glide through the air, at a short distance above the ground, and almost instantaneously vanish; and he began to consider to what natural causes these appearances were to be assigned. They were not meteors—they were too low; they were not glow-worms—they were too high; they were not will-o'-the-wisps; they were not fire-flies; they were not fireworks; what could they be? On the mysterious light again appearing more brilliant than before—dancing up and down the garden, crossing from side to side, and moving in an orbit as eccentric as comets themselves—the scientific gentleman put on his hat and walked quickly out, determined to investigate the wonderful natural phenomena to the very bottom. None can forget how, in the course of his investigations, he unluckily peeped out of his garden gate, and received upon his head "a gentle tap" from the clenched fist of the sagacious Sammy Weller; or how he afterwards demonstrated in a masterly treatise that the wonderful lights were the effect of electricity, and clearly proved the same by detailing how a flash of fire danced before his eyes when he put his head out of the gate, and how he received a shock which stunned him for a full quarter of an hour afterwards. Well, somehow or other many passages in this journal by poor Dr. Scoresby—notwithstanding his real scientific ability—has brought that elderly gentleman of scientific attainments very strongly to our mind.

Perhaps the good doctor's peculiarities have received a heightened colouring from the singularity of the statements in which he refers to his functions as a clergymen on board the Royal Charter. He seems to have had a wonderful sense of the importance of his services in this respect. We find him continually offering to preach in all parts of the ship; so much so that the passengers seem to have been driven to great forgetfulness in the matter of responding to his offers. He appears also to have had so strong a sense of the importance of *his part* of the religious services that he had had several of them entirely to himself before he thought of asking the congregation to take part with him by singing a hymn, and then "the *possibility*" of their uniting in a song of praise and thanksgiving was "suggested" to him after he "had concluded" a certain service. This is not a subject for us to dwell upon; suffice it to say that his congregations appear to have got a little bored with the worthy doctor, for before the voyage out is ended we find him complaining greatly of the insensibility of his fellow-passengers to his ministrations, and learn that his audience has sometimes dwindled down to two—his wife and her maid! He complains, too, that among us Protestants "not only is no respect paid to the minister's official position, but not unfrequently a less value attached to his judgment, on subjects, it may be, professional and critical, than would generally be conceded to a master in any other profession, such as that of medicine or law." What a pity Dr. Scoresby did not live a few centuries earlier!

He seems, moreover, to have been slighted in other ways on board the Royal Charter. He protested against the passengers shooting "with rifles or other guns" at the "unconscious elegant birds gracefully hovering about our rear," when "there was no chance of obtaining them as specimens for the museum;" but no one seems to have attended to his remonstrances. On another occasion, when a flying-fish was caught and served up for dinner, the good doctor seems to have been put off with a very small share of it, for he tells us that "as far as could be judged from *one morsel*" it "*seemed* to be delicate eating." And even with regard to his specific business—that of experimenting upon the compasses of the ship—he did not always meet with the utmost consideration; for several days after they sailed from Falmouth he had to complain that iron-barred sheep-pens, iron-bound trusses of hay, &c., were stowed round about the instruments! Again, on arriving at Melbourne the worthy Doctor was unsuccessful in seeing the bishop and other dignitaries quite as often as he desired, although he was so fortunate (as he does not fail to tell us) as to visit some of the principal public institutions in the city "in Mr. Hart's carriage, and escorted by Judge Barry."

As to the style of Dr. Scoresby's writings in this volume, we may pronounce it wonderful. Mr. Atherton's contributions will have familiarised our readers with something striking in the way of an elevated and complicated style of composition; but we fear Dr. Scoresby will carry off the palm even from him. Here, for example, is a specimen passage—written on the arrival of the Royal Charter in southern latitudes:—

"To us, inhabitants in previous life of northern latitudes, a new phenomenon broke strikingly on our attention, viz., the appearance of the sun performing its daytime progress to the northward, with the astronomical peculiarity of meridian observations being taken with the face of the observed turned towards the Arctic pole!"

In another place—to take a second example—he explains the vibration of the stern of the ship in the following manner:—

"The disadvantage was ascribed to the fact of the direct action of the engine with nothing of intermediate and yielding contacts to break the force of incongruous contacts and operation of the water. The effect was often such as to cause the ship perceptibly to shake in the manner of an elastic flexure as, apparently to sensation, of some inches up and down, giving correspondent vibration in the spanker boom, as supported at the two ends, amounting to a spring-like movement of the intermediate timber up and down."

But there are, even in the "journal" before us, facts of more or less value which we purpose extracting for the benefit of our readers on a future occasion.

Patents for Inventions. Abridgment of Specifications relating to Electricity and Magnetism, their Generation and Applications. Printed by order of the Commissioners of Patents. London: Great Seal Patent Office. 1859.

We have here the most bulky, and perhaps the most important, of that series of abridged specifications of patents which the Commissioners of Patents are so wisely publishing. It comprises no less than 850 pages, and contains short descriptions of all the inventions ever patented in connection with electricity and magnetism, together with a summary of the progress of knowledge in reference to them up to the time of the commencement of the patents. The summary also embraces any discoveries, inventions, or applications that are not treated of in the body of the work, at whatever date they may have been invented or brought into use. We are not, however, we must honestly confess, perfectly satisfied with the manner in which this volume has been edited. Very many of the abridgments are much too long—much longer, that is, than they need have been to answer their purpose, and to stand side by side with those put forth in previous volumes. We observe one abstract occupying very nearly ten pages, and three and four pages are frequently occupied with single patents. The consequence is the volume costs a considerable price—8s. 6d. Such lengths are altogether unnecessary for the purpose of these volumes of abridgments, which can never serve of themselves any other object than that of acquainting readers in a general way with the nature of the inventions. We also observe that the editor has made either more or fewer verbal emendations than were necessary. It seems to us to be a little pedantic to make formal corrections of small and manifest misprints, and yet to find one word spelt in four different ways without corrections ("gimble," "gimboal," "gimbal," "gimbol"). But notwithstanding these small faults, we cordially accept this book from the Commissioners of Patents. They are doing a great and valuable work in issuing these and their other publications, and if they would only give us a proper library to consult them in, we should be doubly grateful to them.

An Elementary Treatise on Logarithms, illustrated by carefully selected examples. By the Rev. W. H. JOHNSTONE, M.A., Assistant Professor of Mathematics at the Royal Indian Military College, Addiscombe. London: Longman, Green, Longman, and Roberts. 1859.

As this little work answers faithfully to the author's intention, we need do no more than repeat what he tells us in his preface. We there learn that the "recent introduction of logarithms into the test required for admission to Addiscombe has induced the author to publish the following treatise. It will be found useful, he hopes, not only to those who are seeking to enter the Royal Indian College, but also to those who intend to continue, or complete, their mathematical studies. The body of the work will be sufficient for students who wish to acquire merely the power of *applying* logarithms to arithmetical operations. The appendices, at the end, are added for those who are desirous of learning the process of *constructing* logarithms. For the understanding of the entire work no more previous mathematical knowledge is demanded than that of arithmetic and the first principles of algebra. It is perhaps unnecessary to say there is no pretence of novelty in the proofs; but the author trusts that he has arranged the subject clearly and methodically, and that he has succeeded in furnishing a serviceable and a sufficiently copious set of examples, about the accuracy of which the utmost care has been taken, and to which there are given proper forms

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according to which the student may work. The advantage, indeed, of cultivating a neat and connected style of writing out logarithmic calculations cannot be too early insisted on. It will be readily admitted by all who have been engaged either in teaching or in examining. The plan adopted in these pages is one that has been recommended by a practical acquaintance with its usefulness."

LIST OF NEW BOOKS.

Johnstone's Elementary Treatise on Logarithms, 2s. 6d.

Manuals of Useful Knowledge.—The Gardener's Manual, 1s. 6d. The Housekeeper's Manual, 1s. 6d. The Youth's Manual, 1s. 6d. The Heavens and the Earth, 1s. 6d.

Overton's Harry Hartley, or Social Science for the Workers, 3s. 6d.

Oxenden's Labouring Man's Book, 1s. 6d.

Thompson's Gardeners' Assistant, 31s. 6d.

NON-INFLAMMABLE FABRICS.

IT is but seldom we have the privilege of addressing the fair sex upon a subject exclusively regarding itself, and those who are most interested in its welfare. Science, which benefits the ladies indirectly, can seldom claim a peculiar interest on their part for any of its wondrous processes and beneficial results. Indeed, were it not for the brilliant fabrics and multifarious contrivances solely intended to minister to their taste, and to a desire to please which cannot be too highly appreciated, they might almost accuse science of neglect. But every spring and every autumn the manufacturer delights in offering new and delicate products of the loom—the freshest and richest *nuances* of colour—at the shrine of beauty, which seeks his aid for its adornment. This aid may not be wholly disinterested—no more, perhaps, than the amiable desire to please to which we have alluded; but it is not now our duty to inquire too closely into the hidden motives and mainsprings which regulate the actions both of women and of men. There is however one omission on the part of the manufacturer which, if not hitherto culpable, proves that *his* desire to please is not allied with a sincere regard for the safety as well as for the appearance of his fair *pratiques*. In supplying them with muslin and with gauze, which, like the new foliage, hail the advent of summer, and flutter in the tepid southern winds, he forgets to label his gossamer wares with the warning "dangerous," which accompanies less destructive and less fatal products of the druggist's shop. And yet one second's contact with flame, the wafting of the fairy robe towards candle or fire, inevitably envelopes its wearer with the devouring element, and exposes her to a terrible death or to fearful disfigurement. Arrayed in such materials, she is surrounded with danger against which no protection can avail; the merest chance, the commonest accident, is sufficient to occasion a sudden and horrible fatality for which there is seldom help or remedy.

We have no need to advert to occurrences of which the lamentable details are familiar to all, and by which some of our brightest and fairest have been removed from our midst, in order to insist upon the necessity for some adequate safeguard against the danger in question. Many a household can tell of casualties which, if they have not been fatal, were the cause of suffering and terror, mingled with thankfulness that a heavier calamity, which had been fully incurred, was yet escaped. But it is now in the power of every one to banish such danger from the list of contingencies to which every household is liable; and it is our cheerful task to point out the means which have been placed at our disposal to secure the safety of those who claim our interest, and have a right to our protection. The practicability and efficiency of these means have already been tested on a large scale; and it is confidently anticipated that they will be adopted by all, being attended with little or no sacrifice of time, money, or appearance.

It has long been known that a material of cotton or thread could be in great measure preserved from the effects of flame by soaking in a solution of alum, or common salt. The expedient is a simple one; but in practice is liable to objections which, more than any wilful disregard or carelessness, have prevented its general employment. The fabric which is soaked in common salt becomes crisp and harsh to the touch; while that which is saturated with alum is seriously injured by the process, losing its strength by reason of the action of the salt upon the fibre. The chemist was therefore called upon to discover a substitute which would exert no injurious effect upon the colour, the appearance, or the strength of the material to be rendered non-inflammable. The investigation—one of considerable research and some difficulty—was undertaken by Messrs. Versmann and Oppenheim, to whom the thanks of the ladies are due for a long series of experiments made in their behalf. It was found that borax exerted a powerful preservative effect; but that the combination of the chemical ingredient impaired, in some degree, the strength of the material operated upon. The effect of more than forty different salts was then tested in the laboratory, the Royal laundry, and various muslin manufactories; and a re-agent was at length discovered answering in every respect the requirements of the manufacturer; who, it is to be observed, finishes his muslins without the application of a hot iron. But more was yet required of the chemist. The amount of the re-agent in question, viz., the phosphate of ammonia, required for a perfect preservative effect, was very considerable; and, moreover, the salt decomposes under the iron of the laundress, rendering the operation of ironing after its employment a matter of some difficulty. The sulphate of ammonia, a salt only one-fourth the price of the phosphate, was found advantageously to replace the latter for the purposes of the manufacturer; a similar preservative action being obtained with a much smaller amount of the re-agent. Both salts, however, are soluble in water, requiring renewal after washing; and both are liable to the same objection with regard to the ironing process. A substance was therefore required to answer a domestic purpose, and which, while allowing the hot iron to pass smoothly over the surface of the prepared material, would afford a perfect guarantee against the effects of flame, without injuring in any degree the strength or appearance of the fabric. A salt fulfilling these conditions was ultimately discovered by the above-mentioned chemists in the *tungstate of soda*. This salt is now in constant use in Her Majesty's laundry at Richmond; and it is to be hoped that its application may quickly become general. It remains only for the wearers of light summer fabrics to require that their goods shall have undergone the preparation through which their wearers will be preserved from the dangers resulting from accidental ignition, and that the laundress also shall employ the *tungstate* solution of the domestic difficulty in obtaining the same desirable result of safety against fire.

ON THE FURTHER ADAPTATION OF THE COINAGE TO THE COMMON NUMERICAL SCALE.

By JOHN TOZER, M.A., LL.D., Serjeant at Law, Senior Fellow of Gonville and Caius College.

TO THE RIGHT HONOURABLE THE CHANCELLOR OF THE EXCHEQUER.

SIR,—The final report made by two members of the Royal Commission which has considered "the practicability and expediency of introducing the decimal principle into the coinage of this country, without contemplating any change in our present system of weights and measures, and without considering the possibility or advantage of an international system of coinage," although, as to one particular scheme it concludes, that "it is not a well-assured or demonstrated improvement on our present coinage," will probably lead to the conviction that the assimilation of our coinage to the common numerical scale which was begun by the issue of the florin must now proceed; and this conviction will be the stronger as the questions put to the witnesses by Lord Overstone, one of the commissioners, seem to raise all the objections that can be made to decimal systems, and show an entire freedom from prejudice in favour of any of them.

The problem now to be solved is:—

How to take the next step toward obtaining a superior coinage, so as to avoid transitional difficulties, and yet obtain a coinage which agrees, for purposes of account, with the common numerical scale, and which in its other conveniences is not inferior to the present coinage.

It is the solution of this problem which I here attempt.

The fact that the base of the common numerical system has but two factors, affords the principal argument against extending its use, and although some conveniences are alleged to attach to the binary scale, I believe it may be assumed that if the base of the numerical system were 12, coins, weights, and measures, would, by common consent, be adapted to that system.

A sound distinction has been adopted by the commissioners, in treating the purposes to which coinage is applied, as separable into two classes; and coins as they are applicable to the purposes of these two respective classes may conveniently be called Coins of Account and Chandlers' Coins.

Coins of account, to be good, must necessarily agree with the common numerical scale, that is, they must be decimal.

Chandlers' coins, to be good, must adopt a base which has, or bases which have, the greatest number of factors that any number not greater than this base, or the product of those bases, can have. It is not an essential merit in chandlers' coins to be decimal, but it is a collateral merit, because it makes them coins of account.

If 12 were the base of the numerical system, chandlers' coins and coins of account would be identical. The advocates of decimals may, I believe, concede that to have a good chandlers' system is as important as to have a good system of account, or more so.

The merit of our present system, as a chandlers' system, consists in its having the factors 2, 3, 4, 6 between the penny and the shilling, and the factor 5 between the shilling and the £; but it is a defect to have the factor 4 encumbering this 5, and making the product of the bases 240. The Austrian system of florin and kreutzer is superior, as it introduces 2, 3, 4, 5, and 6 in the smaller number 60.

I leave the cabalistic symmetry of 1×4, 3×4, 5×4 (Report, p. 27) to be worshipped with that of the seven planets and the seven perfect metals, to which it seems analogous.

Referring to what has been already done towards obtaining a good coinage of account, it appears that

The £ has been taken as the maximum unit.

The florin has been based upon it,

and the House of Commons has resolved,

"That the initiation of a decimal system by the issue of the florin has been eminently successful and satisfactory," and

"That a further extension of the system will be of public advantage."

Further, it has, I think, been sufficiently established by experience, that:—

"The universal law of all decimal coinages is to reduce themselves to two coins of account only, the one being 100 times the value of the other." Report, p. 10.

It follows therefore that if the cent. or 1/100 part of a sovereign be added to the present coinage, the coinage of account will be complete.

Turning now to the chandlers' coinage, this assumption seems to be warranted:

All the advantages of a good coinage of account may be obtained, although some coins that do not belong to the system are retained as chandlers' coins.

This proposition appears not to be admitted, when such facts as the following are found among the arguments that have delayed the adoption of a good system of account:—

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"The decime has never succeeded in supplanting the sous in retail transactions, although for all important calculations the franc and centime notation has become universal." Report, p. 9.

At New York the price of a bottle of beer was called three shillings, although it was inserted in the bill as 37 cents: and generally throughout America although prices are expressed in cents, the number of cents employed shows that coins are still in use that do not belong to the decimal system. Kelland, Report, p. 13.

I assume, however, that the introduction of a good coinage of account is complete, when its notation is used "for all important calculations" and for lists of prices and tavern bills; although the word sous may still be used for five cents, and the confusions of American coinage may not entirely disappear for ages; and that as decimal coinage does in fact make its way steadily and without recoil, its ultimate adoption is certain, although that adoption may never put out of use such words as sous and shilling.

If the object were simply to obtain a good chandlers' coinage, it would be necessary to consider whether it would do to leave the cent to be subdivided into binary fractions, to which it would have, in the opinion of the commissioners, a natural tendency (Report, p, 10); there are, however, the difficulties of transition to be surmounted, and to meet these I think that—

The penny must be retained.

I propose, then, to coin a mite in value 1th of a penny, and as the cent would contain 12 mites, the coins of account and the chandlers' coins would be connected, and every existing coin could be retained excepting the halfpenny and the farthing and even these would be current when they made up pence.

It has been objected to the £ and cent as coins of account, that the cent is too large for a minimum. Bankers at present use a penny, and Professor Kelland says, Report, p. 28:—"It is only by the universal consent of their customers that they are now able to neglect sums less than a penny, not merely in the totals of their accounts, but in every single bill of exchange or other separate item. It is impossible to guess when a similar agreement would be come to with reference to a new minimum."

I believe that this is erroneous, and that a banker consents to borrow the money, and to transact the business of his customer, on the condition that he shall not be troubled with small fractions, and whether 1 or ·5 cents became the minimum would be decided by bankers themselves.

The minimum chandlers' coin would be the mite, and it would, as far as magnitude is concerned, be neither better nor worse than the farthing; it would divide the penny by 5 only, but the cent by 2, 3, 4, 6; and, therefore, unless the value of this property has been overrated, it would be a better chandlers' coin than the farthing.

A half cent would, I think, be an essential coin. The coinage would then stand:—

COINS OF ACCOUNT.

The £ and the cent only.

COINS IN THE DECIMAL SCALE.

	Cents.
£	100
Florin	10
Shilling	5
Sixpence	2·5
Threepence	1·25
Cent	1
½ cent	·5

THE ENTIRE OR CHANDLERS' COINAGE.

	Cents.	Mites.
£	100	
Florin	10	
Shilling	5	
Sixpence	2	6
Fourpence	1	8
Threepence	1	3
Cent	1	
½ cent		6
Penny		5
Mite		1

The fourpence, the threepence, and the sixpence should be allowed to disappear as soon as convenient, and ultimately the peany also; leaving the decimal scale composed of

£, florin, shilling, cent, and half-cent; to which the chandlers' scale would only add the mite.

The mite is used, principally, as a coin of transition; it enables the penny to exist in conjunction with the decimal coins. The additional experience which the use of these coins afforded would decide whether the mite should be permanently retained. When it had discharged its function of introducing the cent without disturbance to existing habits, it might be withdrawn, and the mil substituted; a complete decimal system would thus be obtained.

To recapitulate: I propose that a cent and a mite be coined forthwith, and that public accounts be henceforth kept in the £ and cent.

That as soon as expedient a half-cent stamp be substituted for the penny one.

No coin need be actually withdrawn, but the farthing, halfpenny, threepenny, fourpenny, and sixpenny should disappear as soon as convenient; and there should be no new issue of the penny.

To make a bronze cent of a convenient size would be a problem worth the best attention of the metallurgist; a silver cent would for size be neither more nor less convenient than a threepenny piece.

The extension of the common numerical scale to weights and measures will result from the operation of the causes which lead to its adoption in the monetary system, but will not be a consequence of that adoption, nor necessarily connected with it.

The Report truly states that the weight of scientific authority is in favour of the projected change in the coinage. It is undervaluing the authority of one of those who favour the change to call it simply scientific; the rare power of estimating the wants of non-scientific minds and of bringing the truths of science within their reach, gives to the opinion of one who so eminently possesses it a weight incomparably above that of mere scientific authority.

The Report states also that there is an indifference to the change among commercial classes; the change appeals to the reason and the judgment, and will, therefore, never enlist enthusiasm in its favour. Commercial men have moreover the habit of using the present system, or they employ those who have; there is nothing to force on their attention the advantages of a simpler one.

Give the value of $x+x^2+x+x^4$ when $x=11\frac{1}{2}$d., and find the square of £19 19s. 11½d., are to be found among educational questions propounded during the present century; and they might be restored to their place as such without exciting indignation at Lloyd's.

There is, however, a class neither scientific nor commercial; it consists of men whose education gives them a clear conception of the advantages of the decimal system; and one of this class who has not the mechanical skill which a commercial clerk can acquire, nor the trick of memory which a calculating prodigy possesses, winds through the clumsy complication of a colmun marked £ s. d. with a feeling that the occupation is a degrading one.

The coinages with which the issue of the cent would establish a community appear to be those of Venetian Lombardy, Austria, Holland, Prussia, and France, the franc being, very nearly, four cents. I am, Sir,

Your most obedient and most humble servant,

JOHN TOZER.

3 Inner Temple-lane, 18th Oct., 1859.

A letter from Alexandria says:—The laying down of the electric telegraph between Suez and Aden has, in spite of bad weather, been accomplished by the Cyclops. From Aden the electric wires are to be carried to Schugra, then through Hadramant, a province of Southern Arabia, then to the isle of Socotora, at 250 miles from the Straits of Babel Mandeb, and then by the isle of Ceylon and the Gulf of Bengal to Calcutta. When the line shall become completed, the total length of cable submerged will be 3,750 miles.

UNSINKABLE SHIPS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Woolwich Dockyard, 8th November, 1859.

GENTLEMEN,—My letter on unsinkable ships in the Society of Arts' *Journal* of the 28th ult., and your editorial article thereon in your last week's number (No. 45), have already attracted the attention of inventors with a view to the production of materials suitable for the purpose to which I have alluded, viz., the construction of unsinkable ships; and from the nature of the communications which I have received you will do me a favour, and some of your inventive readers a service, by inserting in your Magazine my letter of the 11th ult. in full as it appeared in the Society of Arts' *Journal*, excepting that I will thank you to place the two extracts from the *Times* in juxtaposition. There is no part of your editorial critique to which I object, although evidently intended to overrule my suggestion. The great use of publicity is to draw the attention of thinking men to the subject that may be referred to, and as all your readers are of a class who think for themselves, I am satisfied that only good can result from any latitude of expression or forced construction of my views on which, as in some respects in this case, you may be enabled to advance some sound and useful views of your own. The practicability of the principle of my suggestion, namely, that ships may be made unsinkable, however perforated by shot, will, I have no doubt, be conceded; but the extent to which the adoption of this principle can be advantageously carried will greatly depend on the properties of the material that may be brought forward, including the few properties that I have enumerated to exemplify my views, and many others, such, for example, as being fire-proof, which it is hoped may be effected now that many preparations have been devised for rendering even wood uninflammable. The comparative expense of such unsinkable ships with reference to any other known mode of preventing accidental foundering, and setting Armstrong's ordnance and, I may add, the contemplated Nasmyth steam ram, at defiance so far as the absolute sinking of such ships is concerned, is essentially dependent on the success that may attend the inquiries now proposed to be set on foot, combined with the plans that may be devised for the application of such material to the construction of floating bodies, whether intended for the purposes of commerce or of war. And here again, as you truly, though rather sarcastically, observe, is a subject for the exercise of inventors "worth a very handsome premium, and the Society of Arts would do well to offer one for it before they offer the other." I concur in this your recommendation to the Council of the Society of Arts, only I would prefer that the required material possessing in the highest degree the properties of specific lightness, toughness, non-absorption of water, cheapness, uninflammability, &c., &c., &c., be determined upon before the premium for its application to the purposes of naval architecture be offered; also, as another preparatory step, I would suggest for consideration this question—Where is this premium to come from? On which point I may observe, that if improvement in modern ordnance necessitated the introduction of iron-cased ships of war such as the Trusty, and if further improvements, such as the Armstrong gun, firing elongated bolts of malleable iron or steel, has already rendered iron-cased ships of the Trusty class no longer trustworthy, but necessitated further improvement in the hope of defying even the Armstrong system of ordnance; as, moreover, the steam ram is looming in the distance, and as it is difficult to see any end to this rivalry of gunnery and rams *versus* iron-cased ships, or of the cost that it will involve, I would merely suggest that if for every one million of money thus devoted by Parliament to the construction of iron-cased shipping with a view to invulnerability, £100 only were awarded as a premium to naval architecture, with a view to promoting the efficiency of unsinkable ships of all classes respectively, it is probable that such rivalry between modern intellect and

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modern ordnance would be conducive to public good and to the peace of the world. For my part I would have little doubt of Britain being at peace with all the world if all ships were effective for their respective uses and unsinkable. Pertinent to this subject it may not be out of place that I here refer to a noble sentiment of Admiral the Earl of Dundonald. It was my official duty in January, 1848, to test the performance of the Banshee, a vessel built by Government expressly for the service. On my return from the trial I found Admiral the Earl of Dundonald at Woolwich Dockyard; I told him of the unprecedented steaming speed we had attained, namely, 16 knots per hour. The noble Admiral replied: "Had I the command of such a ship in war, I would not encumber myself with guns—I would run up to and board everything I could catch." Various essentials to the realisation of this noble sentiment, so characteristic of the man, are obvious; an unsinkable ship with machinery invulnerably cased in, the crew protected from the Minié, and commanded by a Dundonald (and a thousand such men will be forthcoming when required), would be an ugly customer, I guess. But it is not my purpose at present to go into any details of naval architectural construction in connection with unsinkable ships. I will merely observe that the property of being unsinkable does not necessarily imply that such vessels shall have no stowage below the level of the load water line which may be appropriated to machinery; and I may further remark that, by the construction of line-of-battle ships, such as the Royal Albert, only about one-third of the internal cubical capacity of the ship is below the level of the load water line.

In the conclusion of your critique you respectfully invite me to tell you what I am thinking of, and I as respectfully reply that since the introduction of iron cased ships, and especially since the reported practice on the Trusty, I have been occasionally thinking how ships of all classes respectively may be rendered unsinkable compatibly with the respective uses for which they may be designed; and this is the subject on which I now hope to interest the Council of the Society of Arts, and through them, and by the aid of the Society of Arts' *Journal*, and with the co-operation of the MECHANICS' MAGAZINE and other publications usefully devoted to such inquiries, I hope to interest the public. I am, Gentlemen,

Yours very obediently,

CHARLES ATHERTON.

THE GREAT EASTERN AND STEAM SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Mr. Atherton has been so obliging as to favour us with his views on the above subject in reference to some remarks of my own, and he includes a slight notice of the doubt I expressed in my last communication, as to the appropriateness of the formula $\frac{V_3\ D^3}{\text{Ind. h. p.}}$ for determining the dynamic performances of the Great Eastern and of the mercantile marine generally. In order to come to a clear understanding on the suitable application of formula to this vessel, we must divest the subject of some extraneous considerations to which Mr. Atherton has adverted, although proper enough in their place.

Now, it is the performance of the Great Eastern *as a ship*, in the two aspects of velocity alone and conjointly with burthen, and as being the result of a definite amount of *indicated* horse-power, that we have to investigate, and not any merit in the engines and boilers. It is with the scientific application of the power as provided, and not with any development thereof, that we have to do. The formula $\frac{I^3\ D^3}{\text{Wt. of coal.}}$ must therefore be put aside as irrelevant, however useful in other respects. I must, however, remark by the way, that it will ever be vitiated by the factor D^3, if that factor be, as I apprehend, a misleading quantity. Equally irrelevant to the commercial excellence of the vessel is the point of recoaling only at the end of the voyage. That solely concerns the commercial *management*, and though put forward as a desideratum, will, I hope, be found otherwise, through a more valuable freight than coal being secured.

The point, then, exclusively for discussion is that which Mr. Atherton says is the subject of his Table No. 2, "showing the superior capability of large ships, as indicated by the progressively reduced ratio of power to a progressively increased displacement, the speed being constant," and requiring for decision the horse-power as declared by the indicator. In what degree this superiority belongs to the Great Eastern will be satisfactorily determined only when she is deeper in the water than at present, until which time it will perhaps be better to wait; but it is clear from the very nature of the subject, and from these Mr. Atherton's own views of it, that her merits must necessarily be equally pre-eminent with her size, unless there is some awkward circumstance in her build sufficient to neutralise all advantages. Her lines are admitted to be good, but Mr. Atherton thinks unfavourably of her small draught in proportion to breadth. I confess my incompetency to give an opinion on this point, it is so much a question of compromise to be dealt with by the practical man alone, but I must say I should be surprised if it were proved that anything in this circumstance adverse to her performance is not fully compensated by her small breadth in proportion to length, thus having the balance due to capacity untouched. I think, indeed, it would be surprising if it were not far more than compensated, when the great depth to which otherwise she would have been immersed is considered, and the great resistance opposed to the translation of water at such a depth. Mr. Atherton brings down the performance of the Great Eastern to the rather low co-efficient 200, but then he gets at the horse-power, not by means of the indicator, but through the consumption of coals, which is unfair to the ship. Besides, the datum of 3¼ lbs. per indicated horse-power per hour is only a loose estimate.

It was, however, to what I conceive to be a radical fault in the formula used by Mr. Atherton, that I wished to draw *his* attention—whether my proposed correction told favourably or otherwise on the merits of the Great Eastern. Am I to understand that he maintains the appropriateness of that formula, or even indeed its correctness, relatively to its ostensible purpose? or will he acknowledge with me, that the simple displacement would be a better factor than any power thereof? It would in this form be a much more satisfactory criterion of the merits of a ship, in the matter of size and build purely as a scientific construction for a mercantile purpose, and yet for a criterion of practical commercial excellence it would be nearer the truth to take the actual weight of the cargo, by which any peculiarities of construction, such as cellular sides and the like, would be eliminated. But in respect to the formula as it at present stands, will any one speak up for it? In addition to what I have already said, let me ask—what is it that is intended to be expressed? Is it not the power on one side and the effect on the other? But if the entire effect was what is referred to, these quantities would be always equal to each other. It is the useful effect, then, that is meant, and this being divided by the power, gives us the comparative worth of our contrivances for utilizing it as much as we can. Now, what is the useful effect in the present case? It consists in opening out a passage in the water: its positive value depending both on the extent and the velocity with which it is effected, and its comparative value in the dividing and translating of the water, with the least possible velocity given to the least possible number of its particles. Well, then, what need we else for the factors that are to express the useful effect, but the quantities that constitute it—velocity and displacement? The latter term should fix on the mathematical mind the work done in the water, and not technically the corresponding property of the ship. It is true we cannot apportion the work between the useful and the useless, or express either in terms of force and motion; but the useful effect is sufficiently tangible to be measured in a way to serve the purpose of comparison, and therefore cubic feet would stand as well as tons for the displacement. It is of course necessary that the cube of the velocity should be taken; but what does the ⅔ power of the displacement mean? We see that looking at the physics of the subject in the water, we must either take this factor as it is, or discard it altogether, and accept the midship section instead thereof. Perhaps, however, it means this, that it does duty for the midship section—a false fictitious thing instead of the real. In that case, perfect or imperfect, we wander from the effect to the means; we lose sight of burthen altogether, and velocity alone comes to be considered as the useful effect. This limitation is indeed very desirable when we wish to take the comparative worth of the lines simply of different vessels, and the corresponding formula is very appropriate for the Royal Navy, or for mere passenger vessels. But a factor avowedly standing for the midship section is one thing, and a factor virtually representing it, and labelled otherwise, is another thing with another character. The formula in which it stands does not present an honest face; it talks of tonnage and displacement, and makes believe to be a true servitor of solid commercial interests, but under the guise of their own livery, slips away from his charge to run after other masters of the skip-jack race, serving them, by the bye, in the most slovenly manner withal.

I cannot in conclusion refrain from observing—but without any allusion to Mr. Atherton, who, as I understand, is not the author of this objectionable formula—that it certainly justifies to its own extent the animadversions I have often committed to your pages, concerning the frequent deficiency in mixed mathematics of a clear and sound understanding of the physics involved in the subject investigated, by which pompous nothings are enabled to gain, through a mathematical dress, a prestige which they do not deserve.

Yours, &c., BENJAMIN CHEVERTON.

THE INVENTION OF THE SCREW PROPELLER.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Having read in your last week's paper a very interesting account of the invention of a screw propeller by George Blencowe, which I think may not improbably have been the real origin of the one now in general use, I venture to send you a short notice of another inventor, whose discoveries were made a little earlier in time, but were not successful in obtaining any public recognition after their first trial.

Between the years 1821 and 1828, Mr. James Wilson, of Patricroft (subsequently acting-manager to Mr. Nasmyth) made numerous experiments with a view to the construction of a screw propeller for ocean navigation. After many trials, he completed a small model (fitted with both paddle and screw-propellers), which was tried with perfect success at Leith in 1828, in the presence of Mr. Hunter, of Thurston, and other gentlemen well versed in mechanical pursuits. The result was a request from the Highland Society of Edinburgh for a more complete series of experiments on a larger scale, together with the grant of a small sum of money from the Society in aid of Mr. Wilson's undertaking. The first experiments were made on March 10, 1828, and subsequently in April of the same year, and a full report published on May 4th, 1828, by the sub-committee appointed by the Society to witness them, in which it is stated that a boat eighteen feet long had been constructed, and fully tried in the open sea outside the pier at Leith, in a very heavy sea and a stiff N.N.E. breeze, in the presence of Admiral Sir David Milne, Captains Boswell and

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RICHARDSON AND JAFFREY'S IMPROVED BREAKWATER.

FIG. 1.

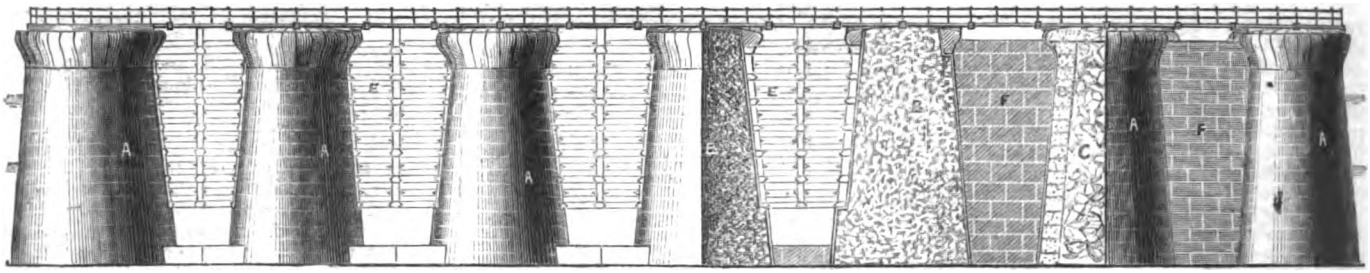
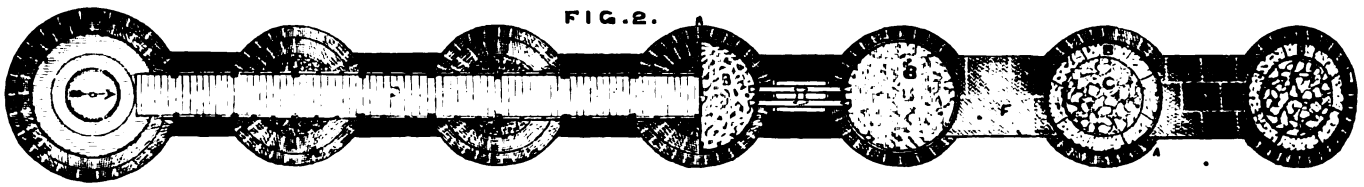


FIG. 2.



Trotter, R.N., and others, and that in the opinion of these gentlemen it had proved entirely successful, the impetus communicated by the propellers at the stern having been much greater than that which could have been given by oars, while the resistance offered to heavy seas on the boat's quarter was also much less.

The model made by Mr. Wilson was deposited in the rooms of the Highland Society, and was destroyed by fire a few years ago when their museum was burnt. Another, but I believe smaller one, is still preserved at Thurston House, near Dunbar, where it has remained for more than thirty years since the late Mr. Hunter first encouraged Mr. Wilson to proceed with his experiments. I believe that Mr. Wilson is about to publish a detailed account of his plans, from which it will clearly appear to what extent he is entitled to claim the invention of the screw propeller. I am, Gentlemen,

Your obedient servant,

W. S. W. VAUX.

British Museum, November 7, 1859.

RICHARDSON AND JAFFREY'S IMPROVED BREAKWATERS.

MESSRS. THOMAS RICHARDSON and G. W. Jaffrey, engineers, Durham, have just completed a patent for an invention which relates to the arrangement and construction of defensive and protective sea works of various kinds, such as harbours of refuge, breakwaters, sea-walls, barriers, and other sea-board structures or contrivances intended either for the defence of the coast against the action of the wind and waves or for protecting shipping. Fig. 1 of the annexed engravings represents in side elevation and partial vertical section a breakwater constructed according to this invention, and Fig. 2 is a corresponding plan and horizontal section of the same. In carrying out the invention in the arrangement and construction of a harbour of refuge for ships the patentees, in the first place, construct a number or series of iron towers *A A*, so that when these towers are deposited in the sea at the predetermined distance asunder, they extend outwards and partially enclose the required extent of sea room. The towers are by preference made of a circular figure in transverse section, wide at the base and tapering towards the upper part, sweeping inwards from the base with a curve, or rising upwards with straight sides of a gradually tapering or conical figure. These towers are by preference constructed of cast-iron or malleable iron, or partly of both kinds of metal, but in lieu of these materials they may be constructed of stone or timber, and made solid in the manner hereinafter described. In constructing the towers of metal a framing of perpendicular and transverse circular or cylindrical ribs is bolted together so as to form a skeleton figure of the predetermined shape. This framing is then covered with sheets of cast or wrought-iron, which are riveted or otherwise secured to the internal framing. "The height and size of these towers must depend," say the patentees, "to a great extent upon the depth of water and the position of the work; we may, however, give as an example of a useful size for these towers diameter at the base thirty-five feet, tapering to a diameter of twenty-seven feet at the upper part. The open bottom towers constructed in this manner are taken out to sea in succession upon a powerful derrick or pontoon, or other suitable floating apparatus, and are then sunk upon the spot required; the towers are arranged in a straight or curved line at such a distance apart as to leave between each an intermediate space equal at the upper part to the smaller diameter of the tower or thereabouts. The towers being disposed in this manner, the water contained within each is then pumped out, and the interior of the tower is filled in with masonry, the blocks of stone being previously cut to the required shape on shore; in this manner the work may be carried on with great rapidity, the cement used in the building operations being meanwhile wholly protected from the wash of the sea water. Instead of using stone as the material for filling in the towers, concrete, beton, or other hard drying plastic cement may be moulded into blocks of the required figure on shore and dried; these blocks when fitted into their proper places within the tower are to be cemented together with a thin mixture of the cement or plastic materiel used for moulding the blocks. In some cases we should give the preference to another mode of procedure, namely, to fill the whole of the interior of each tower with 'beton' or hydraulic cement, as shown at *B*, which cement solidifying within the tower, the whole forms a compact and solid mass capable of withstanding the waves of the sea after the removal or wearing away of the external plates of metal. In lieu of this solid mass of beton, a filling-in may be used composed of beton, having a central mass or core of slag as at *C*, the interstices of which may be filled up with the liquid, so as to form the whole into a solid mass. The operation of filling up the towers with masonry or with plastic materials is materially facilitated by the convenience which the summits of the towers afford for at once laying down a permanent gangway or road *D* from one tower to another, along which gangway materials and implements can be conveyed with nearly the same facility as on shore. In this manner the expensive and costly plant required in harbour and coast works of the ordinary kind are wholly dispensed with, and the work is done at far less cost than can be accomplished with the usual structures. In place of constructing the towers of iron, they may be built wholly of stone, a suitable caisson being sunk over the spot where the tower is to be erected; the water having been pumped out of the caisson, the work may be carried on with great rapidity if the several blocks of stone have been previously cut to the required shape on shore. The open spaces between the contiguous towers are filled in with open vertical frames *E E*, which serve to break up and divide the waves as they roll in, the water passing through the open screens without hindrance, and yet in a comparatively smooth and untroubled state, and so as to render the position of the shipping in the harbour perfectly secure. These lattice screens are constructed of balks of timber strongly bolted together, open rectangular spaces being left between the contiguous vertical and transverse beams of timbers. These lattice screens are by preference constructed on shore, and in the opposite faces of such contiguous pair of towers, a deep vertical groove is formed, either by bolting pieces of angle iron to the face of the tower, or by casting the grooves in the plates of towers, or by securing pieces of timber thereto in a similar manner. These lattice screens are taken out in succession on the derrick, they are raised thereby to a sufficient height to admit of their being lowered down into the grooves made for their reception on the contiguous faces of the towers. Another mode of constructing these screens is to form them of cast-iron pipes or of malleable iron tubes. The vertical tubes are connected together so as to form a frame or lattice by means of transverse bars of metal at the upper and lower parts, and, if necessary, at intermediate distances. These screens are fitted into the adjacent grooves in the towers in the same manner as described in reference to those composed of timber. In addition to the protective action of these screens there is another and highly important advantage attending the use of them in harbour and other similar sea works, which is, that from their open construction they prevent the silting up or accumulation of the sand inside the harbour, as the tide has free access and egress through the open screen so that the original depth of water is maintained, and a prolific source of expense in the maintenance of dredging apparatus is avoided. The construction of harbours, piers, or quays upon this plan admits of vessels approaching close up to the towers, thus avoiding the waste of room and inconvenience attending long sloping sea-walls of the ordinary construction. Even in situations where a rigid or impermeable sea-wall would not be objectionable, our system offers considerable advantages in point of strength, economy of first cost, and facility of construction. In such situations the towers are constructed and disposed as hereinbefore described, but the intermediate spaces between the towers are filled in either with a wall of masonry as at *F F*, or are formed of blocks of 'beton' or concrete cemented together, and

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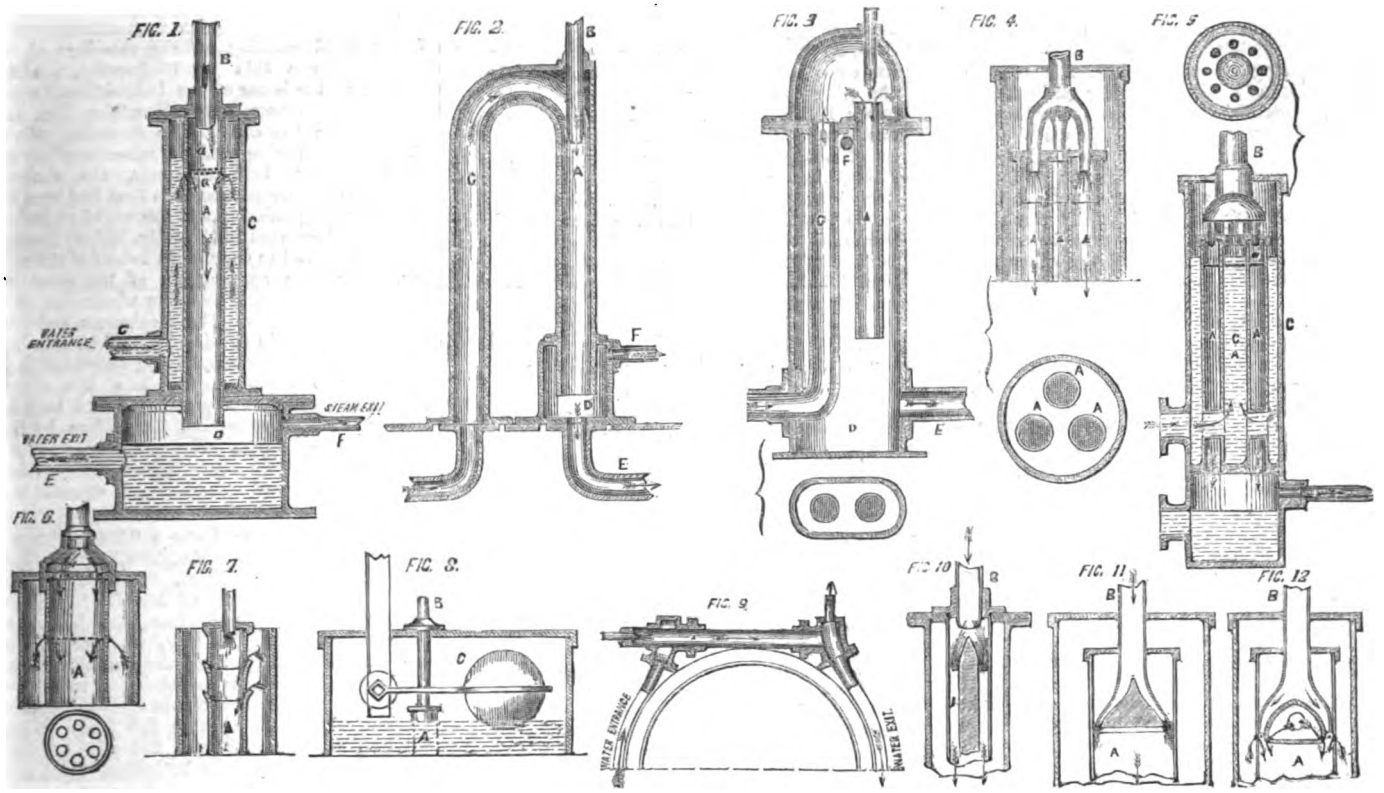
CLARK'S APPARATUS FOR HEATING FEED-WATER.



defended or not on the outer or seaward side by a lattice-work of timber or metal. For these structures the towers may either be the simple iron tower sunk into its proper place, or it may be partially or wholly filled up with masonry, 'beton,' or other suitable material. According to this system of constructing harbours, breakwaters, sea-walls, and other similar exposed works, it is impossible to carry out such works in a manner more economical, for if properly conducted no portion of the materials employed need be wasted, which is far from being the case in structures of the ordinary kind, however careful the contractors may be in the disposal of their materials."

CLARK'S APPARATUS FOR HEATING FEED-WATER.

MR. DANIEL KINNEAR CLARK, the well-known writer on railway machinery, has patented for the above purpose an invention of which he gives the following description:—

The invention consists in a simple and compact method of heating the feed-water of steam-boilers by the forcible and immediate intermixture of currents or jets of water and steam brought into direct contact and travelling together, as follows:—One or more jets of steam are discharged freely and directly through a pipe or other passage or chamber of suitable form, into which also the water to be heated is delivered, and through which it is passed in conjunction with the steam; in this confined passage the steam, in virtue of its initial velocity, forcibly impinges upon, mixes with, and disperses the water, and is quickly condensed, and the water is proportionally raised in temperature by the heat of the condensed steam. When more than one jet of steam is used, the jets may be placed side by side, or they may be placed in succession. When the heating apparatus is above the level of the source of water supply, the water may be raised to it by pumps or other external means. The jet of steam is so adjusted as by suction to draw and conduct the water into and through the heating passage, thereby assisting and, if powerful enough, superseding the use of external means for lifting the water. The jet nozzle may be contracted at the orifice to sharpen the blast. The water may be delivered round or within the jet of steam, which in the latter case is annular, or there may be a series of jets in a circle.

The heated water passes freely from the apparatus, and may be either pumped directly into the boiler or reserved for use. A free vent is provided for uncondensed steam. The supply of steam may be taken from the boiler direct, or from the exhaust passages of steam engines connected therewith, whether condensing or non-condensing. For convenience the whole of the exhaust steam may be carried through the heating chamber, the surplus or uncondensed steam being passed on to the atmosphere or condenser, as the case may be.

The apparatus may be made with parts readily removeable and easily replaced for collecting deposits from impure water. The vent for steam may be closed, if desired. Air vessels may be applied where needed for equalizing the flow of water. The water may enter through the open end of the heating passage or through perforations; and the heating chamber may be formed with one or more contractions or strictures, so as to induce more intimate mixture of the water and steam, or with one or more bends or undulations.

The heating chamber or passage should be of sufficient length to effect the thorough heating of the water, but it may be supplemented where needed by one or more diaphragms placed within or beyond the passage, so as partly to baffle or divert the discharging currents of water and steam, and further to intermix them.

When the steam is delivered intermittently at considerable intervals into the heating chamber, as in the exhaustion of steam from an ordinary steam engine, the supply of the water to be heated may likewise be delivered intermittently, in order that cold water may not pass unheated through the heating chamber in the intervals of the discharges of steam. The intermittent supply of the water may be effected in a self-acting manner by the exhausting operation of the steam inducing a partial vacuum and a flow of water into the heating chamber through the water entrances, against which flap or other simple acting valves may be placed, so as to open inwards when exhaustion is effected; or it may be effected by means of stop-cocks, or valves, or intermittent pumps, actuated by the engine. By means of valves, also placed at any convenient part of the delivery pipe or chamber, the supply-water may be sustained at the level to which it is elevated by the inducing action of the steam. The whole of the steam from donkey pumps used in feeding steam-boilers may be condensed in this manner. The apparatus may be protected by a jacketing of steam from the exhaust or otherwise, or by a coating of felt or other material, to increase its efficiency by the addition of heating surface, and to prevent loss of heat.

The annexed illustrations exhibit various forms of the apparatus. In the Figures generally, *A* is the heating chamber; *B* is the steam pipe, from which the steam for heating the feed-water is discharged; *C* is the pipe, conduit, or vessel which contains and conveys the water to be heated. The water enters the heating chamber through perforations or slots *a*, *a*, so as to meet and mix with the entering steam, and the heated water is discharged into the cistern *D*, from which it is drawn off by the pipe *E* to be pumped into the boiler. Any residual steam in the cistern *D* may escape through the waste pipe *F*.

In Fig. 1 the heating chamber is enclosed in the water conduit, and is surrounded by the water. The tight air space at the upper end of the conduit acts as an air vessel. The steam nozzle is fitted air-tight into the heating chamber, in order to prevent the suction of cold air into the chamber, and the loss of heat thereby, and to sustain the exhaustive action of the steam. In Fig. 2 the heating chamber and water conduit are placed side by side, and united at the upper parts where the steam is admitted. In Fig. 3 the heating pipe and water pipe are enclosed within a chamber which contains the heated water. The cold water is discharged into an upper chamber, whence it proceeds to the heating pipe. In Fig. 4 there are three heating pipes and three steam nozzles, one to each pipe, enclosed within the water conduit. In Fig. 5 there are several steam nozzles placed in a circle, playing into an annular

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heating chamber placed within the water chamber. The cold water enters the annular chamber from within and from without. In Fig. 6 the steam is admitted in several jets into the heating chamber, which in this case is plain. In Fig. 7 the cold water is admitted in one or more thin sheets into the heating chamber. Fig. 8 illustrates the adaptation of a ball-cock to the cold water supply-pipe, to maintain the water at a constant level in the cold-water cistern, and is useful when the water is supplied from above the level of the heating apparatus. Fig. 9 shows an application of the invention to a locomotive, in which the heating chamber is placed horizontally over the barrel of the boiler. One pump may be employed to supply the cold water, and the other pump to supply the heated water to the boiler. When the feed pump is not in action, the heated water flows freely back into the tank or tender. Figs. 10, 11, 12, 13, show various other forms of the apparatus. In Fig. 10 a core is introduced within the heating chamber under the steam nozzle to diverge the steam, and so to promote the mixture of the steam with the water. In Fig. 11 the steam is discharged from an annular orifice near to the circumference of the heating chamber. In Fig. 12, also, the steam is discharged from an annular orifice, and the water is introduced against the steam from within and from without the annular orifice.

In the illustrations it has not been thought necessary to show in detail any of the obvious and well-known modes of conveying steam to the heater, or of inserting linings or vessels for the collection and easy removal of deposits from impure water. It is obvious also, without further illustration, that by a suitable disposition of cocks or valves the apparatus may be turned off at any time and the engine maintained in working order.

STEAM NAVIGATION ON THE RIVER AMAZON.

MR. LAIRD, of Birkenhead, has just completed a vessel for a company formed under the auspices of the Baron de Mana, of Rio Janeiro, for the navigation of the river Amazon. This vessel is named the Manàos, she is 265ft. long and 25ft. beam. Her tonnage, old measure, is 681, and she is intended to combine great carrying capacity with speed. She is arranged something on the plan of the American river boats, the decks being carried out to the extreme width of the paddle-boxes, and the whole of the accommodation for first and second-class passengers is in large deck houses, leaving the holds entirely free for cargo and coals. Her engines, also constructed by Mr. Laird, are of 180-horse power nominal, but worked on the trial to between 950 and 1,000 indicated horse-power. The paddle-wheels are on the feathering plan, and the boilers are fitted with superheating apparatus, and other modern improvements. In order to test this vessel's capabilities for speed and seagoing qualities, she was despatched from Liverpool to Beaumaris on Monday last, and made the passage from the Rock Light (a distance of 48 statute miles) in three hours, giving an average speed of 16 miles per hour. She returned from Beaumaris to Liverpool on Wednesday in 2h. 50min., being an average speed of 17 miles per hour. The Manàos was partially loaded, and had on board two large iron barges shipped in pieces, to be riveted together on arrival at Para, besides a considerable quantity of coal. The distance between Liverpool and Beaumaris has never been accomplished in so short a time before. The vessel and machinery have been constructed, and the above trial of speed made, under the superintendence of Commodore Hoffsmith, a distinguished officer of the Brazilian navy, who was sent over by the company for that purpose, and also to superintend another vessel now being constructed by Mr. Laird for the same owners.—*Times.*

A number of additional hands have been set on recently at Woolwich Dockyard and Steam Factory Department, and riggers are still required, who will receive a considerable advance of wages.

THE STRENGTH OF WROUGHT IRON AND STEEL.

THE following condensed abstract of a first set of experiments, made by Messrs. Robert Napier and Sons, on the strength of wrought-iron and steel, was communicated to the British Association at the Aberdeen meeting by Professor W. J. Macquorn Rankine, C.E., LL.D., &c.:—The experiments to which this abstract relates form the first set of a long series now in progress by Messrs. Robert Napier and Sons, the details being conducted by their assistant, Mr. Kirkaldy. The whole results are now in the course of being printed *in extenso*, for publication in the "Transactions of the Institution of Engineers in Scotland;" but some time must elapse before they can appear, owing to the great volume of the tables, and the number of particulars which they give.

The present abstract is all that it has been found practicable to prepare in time for the meeting of the British Association, and, notwithstanding its brevity and extreme condensation, it is believed that the results which it shows will be found of interest and importance. It gives the tenacity, and the ultimate extension, when on the point of being torn asunder, of the *strongest* and the *weakest* kinds of iron and steel from each of the districts mentioned. Each result is the mean of four experiments at least, and sometimes of many more.

The detailed tables, now being printed, will show many more particulars, and especially the contraction of the bars in transverse area along their length generally, owing to "drawing out," and the still greater contraction at the point of fracture. The experiments now complete were all made with loads applied gradually. Experiments on the effect of suddenly applied loads are in progress.

TABLE A.—IRON BARS.

	Tenacity in lbs. per sq. inch.	Ultimate extension in decimals of length.
Yorkshire: strongest	62886	0·256
" weakest	60075	0·205
" (forged)	66392	0·202
Staffordshire: strongest	62231	0·222
" weakest	56715	0·225
West of Scotland: strongest	64795	0·173
" " weakest	56655	0·191
Sweden: strongest	48252	0·264
" weakest	47855	0·278
Russia: strongest	56805	0·153
" weakest	49564	0·133

TABLE B.—IRON PLATES.

Yorkshire: strongest lengthwise	53005	0·141
" weakest lengthwise	52009	0·131
" strongest crosswise	50515	0·093
" weakest crosswise	46221	0·076

NOTE.—The strongest lengthwise is the weakest crosswise, and *vice versâ*.

TABLE C.—STEEL BARS.

Steel for tools, rivets, &c.: strongest	132909	0·054
" " weakest	101151	0·108
Steel for other purposes: strongest	92015	0·153
" " weakest	71486	

TABLE D.—STEEL PLATES.

Strongest lengthwise	94259	0·0571
Weakest lengthwise	93591	0·1986
Strongest crosswise	96303	0·0364
Weakest crosswise	69016	0·1961

NOTE.—The strongest and weakest lengthwise are also respectively the strongest and weakest crosswise.

COINING BY CONTRACT.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—In the article "Coining by Contract" in your last week's impression, you assume that we have obtained a promise of contract for the proposed new bronze coinage.

We beg to state that we have received no such promise, either directly or indirectly, and that we are not in any way responsible for the paragraph in the *Manchester Guardian*, from which the inference has been drawn.

Your obedient servants,

RALPH HEATON AND SONS.

Birmingham, November 7th, 1859.

Proceedings of Societies.

INSTITUTION OF MECHANICAL ENGINEERS.

THE general meeting of the members of this Institution was held on Wednesday, the 2nd instant, at the house of the Institution, Newhall Street, Birmingham, Henry Maudslay, Esq., Vice-President, in the chair. The Secretary (Mr. W. P. Marshall) having read the minutes of the previous meeting, held in Leeds, the chairman alluded to the irreparable loss that had been sustained by the profession and the world at large in the recent lamented death of Mr. Robert Stephenson; and desired to express, on behalf of the meeting, their high appreciation of his great mechanical genius and their warm admiration of his many noble qualities. Mr. Stephenson had taken a strong interest in the development of the Institution in its earlier years, having succeeded in the presidency his father, the late Mr. George Stephenson, their first president; and both had largely aided in promoting its welfare by their counsel and assistance. A considerable number of new members were elected; and the president, vice-presidents, and members of council were nominated for the next annual election.

The first paper read was a "DESCRIPTION of OATES'S BRICK-MAKING MACHINE," by MR. JOHN E. CLIFT, of Birmingham. In this machine, which is the invention of Mr. J. P. Oates, of Erdington, near Birmingham, the bricks are made direct from the clay, without previous preparation beyond passing through the ordinary crushing rollers when containing a mixture of stones. The machine consists of a revolving vertical screw with a large flat blade, widened conically at the upper part, and working freely within a cylinder, at the bottom of which is the mould block, sliding horizontally, containing two moulds in which the bricks are formed. The upper part of the cylinder is expanded to form a hopper, into which the clay is supplied, and is then drawn down into the cylinder by the revolution of the screw and pressed into the mould below. The mould thus filled is then withdrawn horizontally, and the other empty mould brought under the screw to be filled with clay; and the first brick is discharged from the mould by a vertical piston pushing it through the open bottom of the mould on to an endless band, by which it is conveyed to the front of the machine ready to be removed direct to the kiln for burning. The clay is supplied continuously by the action of the screw; and, at the instant when the bottom of the clay cylinder is closed by the change of moulds, an outlet for the clay is provided by means of a horizontal escape pipe, opening from the bottom of the clay cylinder, and acting as a safety valve to prevent any excess of pressure in the machine or any risk of over-straining. The outer end of this escape pipe is open, and the friction of the clay against its sides determines the limit of pressure in the machine: the clay is pushed forward in the pipe ¼ or ½ an inch each time the brick moulds are changed. The bricks are completed at a regular rate of 12,000 per day in ordinary work, or an average of twenty good bricks per minute; and the machine is capable of making as many as thirty bricks per minute. Several of these machines are at work in the neighbourhood of Birmingham and elsewhere, some of which have been working regularly for three years. The crushing strength of the bricks has been found to double that of hand-made bricks of the same district; and their transverse strength is also considerably greater than that of hand-made bricks. No difficulty is experienced from the bricks not having been dried before stacking in the kiln for burning, as they are sufficiently dry on leaving the machine; so that the process of drying required for hand-made bricks previous to burning is dispensed with. A number of samples of the ordinary bricks made by the machine were exhibited, and specimens made from different qualities of clay in different parts of the country; also a working model of the pressing screw and escape pipe of the machine, showing the

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action of the vertical screw in forcing the clay out laterally through the horizontal pipe.

The next paper was a "DESCRIPTION OF A NEW CONSTRUCTION OF HIGH-PRESSURE STEAM BOILER," by MR. J. FREDERICK SPENCER, of London. This boiler, the invention of Mr. M. Benson, of Cincinnatti, U.S., is of tubular construction, and is designed for the purpose of generating steam of high-pressure without risk of accident to any portion of the boiler, by producing an artificial circulation of the water in the boiler, by mechanical means; it is also intended to combine great lightness and compactness of construction. The boiler consists of a series of horizontal tubes of small diameter, arranged in parallel rows over the furnace, and communicating at top and bottom with a receiver placed outside. The mechanical circulation of the water is produced by means of a pump worked by the engine, which draws the water from the receiver and drives it through a series of tubes, from the top of which it passes back into the receiver in the form of mixed water and steam. The boiler is divided into separate sections, each communicating independently at top and bottom with the receiver, and capable of being readily removed for repairs; the series of tubes in each section are connected alternately at the ends by semicircular bends, so that each section presents a continuous passage for the water, which is driven through the tubes by the circulating pump at the rate of about ten times the quantity evaporated. The power required to work the pump is very small, having merely to overcome the friction of the water in passing through the tubes; and in first getting up steam the pump is worked by hand for a short time, until there is steam enough to work it. The quantity of water contained in the boiler is much smaller than in ordinary boilers, enabling the steam to be raised in a much shorter time; while the mechanical circulation ensures all the water being uniformly heated throughout, and prevents any part of the tubes being burnt in consequence of deficiency of water. The risk of explosion of any part of the boiler is much diminished, the tubes being of great strength in consequence of their small diameter, while the receiver is not exposed to the action of the fire. Several of these boilers have been at work for some years in America, where they are in use principally for steam fire engines; for this purpose their rapidity in raising steam is of great value, and steam of 60 lbs. per square inch pressure has been raised in as short a time as six minutes from cold water. The tubes are found to be very durable, and do not become choked with deposit, though the boilers have been worked for many months with water containing a large amount of deposit; the deposit is carried over continuously into the receiver, while the tubes are kept clear by the regular flow of water produced through them by the mechanical circulation.

The meeting then terminated.

ASSOCIATION OF FOREMEN ENGINEERS.

On Saturday the 6th inst, *the Association of Foremen Engineers* held their ordinary monthly meeting at St. Swithin's Hall, City, Mr. Newton, President, occupying the chair, and Mr. John Jones, Secretary, the vice-chair. Soon after 8 p.m. the business of the evening was opened by the reading of the minutes of the previous meeting, the formal electing of Mr. Ebbery as an ordinary, Mr. Fowler as an honorary member, and the nomination of Mr. Hepburn, of the Small Arms Factory, Enfield, as a prospective ordinary member. There was a goodly assemblage of foremen present, and the President next called upon Mr. C. F. HAYES to continue his series of papers on THE MANUFACTURE OF SMALL ARMS That gentleman at once responded to the invitation and proceeded to describe in his usual terse and explicit manner, the various parts of the rifle musket which are known as its "furniture." The *trigger* was first spoken of. This was of wrought iron, roughly forged in the first instance, then struck, at a proper heat, into a pair of dies, then put through a succession of milling, or drilling operations and lastly polished and case hardened. The *trigger plate* was of brass compound—as is all the brass portions of the furniture of the rifle—of a mixture of sixteen parts copper, ten of zinc, and one of lead. It was passed through several milling, drilling, and tapping processes, and edged by a machine which, originally of American origin, had been much improved by Mr. Hague. Finally it was polished on buff wheels and made ready for attachment. The *guard plates*, also of brass, had to pass through a number of machines prior to polishing, and these were described by Mr. Hayes. The *butt plate*, of brass, thanks to the ingenious arrangements made by Mr. Hague, who had been rewarded by the War Office for his pains, was finished off much more rapidly and perfectly than heretofore, the machines used being admirably adapted to their purposes. The *ramrod*, of steel, except the rammer end, which was of wrought iron, had to be clamp-milled, screwed, hardened and tempered, then ground, polished, tested, and gauged. The *nose-cap*, of brass, was now, owing to important improvements made by J. H. Burton, Esq., chief engineer at Enfield, finished with great rapidity and consequent economy. The *rod-spring*, of steel, was forged by hand into a die, then bent into a spoon shape, and afterwards milled, hardened, tempered, and polished. The *rod-stop* was punched out of a rod of iron, filed by hand, and thus finished. The *side-cups* were punched from sticks of cast-brass, then coned in dies, drilled, counter-sunk, milled to thickness, and polished. Next came the *bands* for fastening the barrel to the stock, and in the mode of treating these the chief engineer had recently devised considerable improvements, principally in the forging, and which involved the use of Nasmyth's steam drops, dies, &c. By these means great economy of labour and of money were effected. These bands were as neat when completed as the bracelets of a lady, and, as might be imagined, they underwent much careful manipulation. The *guard* and *band swivels* were of wrought-iron, put through numerous minute operations, and lastly "blued." The *screws*, *nuts*, and *pins* for the whole of the furniture, although not attracting much attention when in their places, were all prepared with such accuracy as to preclude the possibility of their turning loose in action, and were indeed most carefully fitted.

The *back-sight* was a most important piece of furniture. By its means the rifleman regulated the range of his rifle, and made sure of his mark whether it was at 100 or 1,000 yards distance! The "bed" of this contrivance, which rested on the barrel of the weapon and closely fitted it, was of wrought-iron, forged firstly by hand, and secondly struck between top and bottom dies under Colt's screw drop hammer.

About fourteen or fifteen distinct processes were wanting before the *back-sight* with its graduated guage, springs, and fitments was ready for application to the breech of the rifle; and lately a prize had been awarded to Mr. Williams, of the Enfield factory, for certain improvements in some of these processes. The *slide*, the *leaf*, the *spring*, and the *cap* form parts of the back-sight, and each requires careful workmanship.

It is needless to say that the above is but an abstract of the valuable and comprehensive paper read at the meeting of Foremen Engineers on Saturday, and to the thorough comprehension of which Colonel Dixon, R.A., of Enfield, contributed largely by allowing specimens of each article of "furniture" alluded to to be "laid on the table." The *lock* and *stock* of the rifle will form the concluding themes of Mr. Hayes' elaborate dissertation, and the manufacture of these will be explained at the ensuing December meeting.

Some beautiful LUNAR PHOTOGRAPHS and MAGNETIC DIAGRAMS, kindly forwarded from the Royal Observatory at Kew, were, at the conclusion of the above-named paper, handed round and explained by Mr. Beckleigh. These excited much interest among the numerous auditory—who were anxious, as a gentleman happily expressed it, to "learn of the invisible through the medium of the visible." It was eleven o'clock before the pleasant proceedings of Saturday came to a close, and it was only regretted that employers—who, according to a contemporary, are afraid that "shop secrets" are divulged at their foremen's *réunions*—were not more numerously represented on the occasion in the handsome apartment in which this meeting was held.

Messrs. Keyte (of Woolwich), Briggs, Ballard, the President, and others took part in the friendly discussion which ended the meeting, and all departed with a high sense of gratification.

WATCHMAKERS' ASSOCIATION, COVENTRY.

ON Tuesday evening, Nov. 1, a lecture on horology was delivered by JAMES FERGUSON COLE, Esq., Vice-President of the British Horological Institute, London. Mr. Cole was accompanied by Messrs. Brooks and Sheppard, members of the Council of the Institute. The attendance was very large, and amongst those present were some of the principal watch manufacturers in the town.

The Lecturer said he had accepted the invitation to deliver a lecture, in the hope of being able to submit a few observations referring to the the principle of timekeepers, but chiefly with regard to chronometers and pocket-watches, as portable machines dependent for time-keeping effect on the vibratory motion of a balance governed by the elastic resistance of a balance-spring; while clocks, as fixed machines, depended upon the oscillatory motion of a pendulum, governed by the principle of gravity. With reference to the "spring" or "weight," as the usual motive power applied to the machines alluded to, he explained that neither one nor the other of these was of itself a power, and hence the mainspring as belonging to the class of timekeepers now treated on might be considered as only a reservoir of the force exerted by the hands in the act of winding up the spring. Elasticity was not, therefore, a power, but, on the contrary, a constant principle of resistance, tending only to obstruct motion, and to remain, like the inert matter of a weight, constantly in a condition of rest; but when a spring was woundi nto tension, its tensile force would be given out in the way of re-action, and whether it be a mainspring, a balance-spring, or the tremulation of a bell, all were alike obedient to the great ruling principle of nature, in which the deepest philosophical scrunity had never detected the smallest error. Having described the construction of the chronometer or pocket-watch, he proceeded to observe that escapements were of various constructions, but those most generally adopted in the manufacture of watches during the last half century were the horizontal, the duplex, the chronometer detached, and the detached lever escapement. There was also another class of escapement, known as the Remontoire, but after many experiments, he found that the remontoire spring must always be fully under control of the mainspring at its lowest tension as an arbitary condition, and that when the mainspring was fully wound to its highest tension the pressure from the motive force to the scape-wheel locking was so great against the delicate remontoire spring which had to discharge it, that it required too nice an adjustment of the force and resistance to be relied on. The same disadvantage attended the remontoire in regard to fusee movements, where the maintaining spring was inferior to the mainspring; and although the same objection to the remontoire did not so strongly apply where the motive power was uniform by a weight as in clocks, in this application of the principle, under the most favourable circumstances it was still open to objection, as the smaller irregularities of power through the train of wheel-work, together with the impediment of thickened oil, and the effect of various temperature on the spring, rendered this delicate winding action so very doubtful that he had long since given up the use of the remontoire escapement. The principle involved in all escapement mechanism in watches

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was in its general aspect of simply a mechanical character, and, viewed in this light, must appear only as a means of transmitting impulse power to the pallet plains. Such, however, was not strictly the case, as any undue resistance arising from defective application, or from a want of correctness in the formation of the locking angles, &c., on whatever principle of escapement, was well known to affect both the mechanical result in motion produced, and also the isocheronous result on time. With regard to the lever escapement now generally adopted for ordinary pocket watches, the rudimentary principle was strictly that of Graham's pendulum clock, although ascribed to Mudge as its inventor, and it must be regarded in its present shape as a valuable improvement for its greater simplicity and ease of execution, and as effecting the important object of detachment of the balance. In reviewing as he had done the various modes of construction of chronometers, pocket-watches, and other time-keepers, it was not his intention to offer any rigid rule or process for the attainment of an end which practical watchmakers arrived at by their own peculiar modes established by custom and experience. What he proposed was a reduction of the proportions of the mechanical parts of the detached lever escapement to a rule, which, if correctly observed and adopted, must lessen or prevent the liability to failure in the ultimate mechanical and time-keeping results when made by workmen of less mature experience. The first consideration was, what should be the proper diameter and weight of the balance for the proposed watch movement; This, he need not say to the scientific watchmaker, was only to be ascertained in the first instance by mechanical trial and by the result in motion produced. That the weight should bear some preferrable relation to the diameter could not be doubted, as either carried to an extreme must destroy the harmony of proportion. The lecturer here proceeded to detail at considerable length the mode by which he had attained the object alluded to, and with the aid of diagrams clearly showed to his audience the state of simplicity to which he had reduced his principle. In conclusion, the Lecturer urged upon all watch manufacturers the desirability of rendering the construction of chronometers, pocket-watches, and other timekeepers as little complicated as possible, remarking that all the varied and improved modes of action described by him had been found to work well, and it was owing to their being based upon the simplest form of the principle that he gave them the preference.

INSTITUTION OF CIVIL ENGINEERS.

TUESDAY, NOV. 8.—The first meeting of the present session took place in the evening of this day: previous to commencing the proceedings the president, Mr. J. Locke, M.P., offered a few observations as a tribute to the memory of Brunel and Stephenson—two of the Institution's "most honoured and distinguished members."

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

November 1st.—J. P. Joule, LL.D., F.R.S., Vice-president, in the chair. A paper was read by Mr. JAMES G. LYNDE, M. Inst. C.E., F.G.S., on EXPERIMENTS ON THE STRENGTH OF CAST IRON GIRDERS.

October 5th.—MATHEMATICAL AND PHYSICAL SECTION. The following gentlemen were elected officers of the section for the present year:—President, Robert Worthington, F.R.A.S., Vice presidents, J. W. Long, F.R.A.S., E. W. Binney, F.R.S., F.G.S., Treasurer, Joseph Baxendell, E.R.A.S., Secretary, Mr. Thos. Heelis.

October 13th, 1859.—Mr. Baxendell read a paper ON THE PHENOMENA OF GROUPS OF SOLAR SPOTS.

A paper was also read by Mr. Thomas Carrick, on the relation which appears to subsist between ORBIT DISTANCES AND ORBIT INCLINATIONS, when the latter are referred to the solar equator as a fundamental plane.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to H. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

OUR APPEAL.

IN addition to the numerous sums announced in our last number, we have received the following:—J. S. R., £2 2s.; J. C., £2; C. S., 10s.; R. L. T., 10s.; C. P. C., 10s.; S. H. B., 5s; An Inventor, (Glasgow) 2s. 6d. The total sums received up till to-day, Thursday, amount therefore to £22 5s. 6d. For this we are requested to express the heart-felt thanks and gratitude of the receiver. We need not, we are sure, multiply words on this subject. We will only say that the sum already equals our expectation, seeing that the claim upon our readers was a remote one, and supported by no recommendation save that of pure charity. Of course if more is sent we shall be happy to receive and forward it.

Our Weekly Gossip.

THE following suggestion from Mr. Chubb, of the well-known firm of St. Paul's Churchyard, London, should be attended to:—

GENTLEMEN,—The loss of the Royal Charter should direct the attention of shipbuilders, and others interested in the matter, to the improper method of constructing the bullion rooms on board ship. These receptacles are usually formed by lining some nook or corner with strong iron plates, bolted to and forming part of the ship, so that if the vessel gets on shore and breaks up, the bullion room necessarily goes to pieces with it, and the contents are dispersed. I would suggest that these safes should not be in any way connected with or fixed to the ship. In case of a wreck and the breaking up of the vessel on shore, the safe would go to the bottom, preserve its contents intact, and be readily recovered. As a safe four feet square will hold more than 2,000,000 sterling, very little space would be interfered with.

I am, Gentlemen, your obedient servant,

J. CHUBB.

St. Paul's Churchyard.

When the fleet was off the Eddystone lighthouse in the late gale, Admiral Elliott, with the true spirit of a true British admiral, decided at once to "wear the fleet together and stand off and face the gale," and while doing so a man fell overboard from the jibboom of the Trafalgar, which with the Emerald and Aboukir formed part of the "sternmost line;" but notwithstanding the violence of the gale and the heavy sea running at the time, one of the cutters with a full crew in it was instantly lowered by "Clifford's" lowering gear, (as now generally fitted by the Admiralty in the ships of the Royal Navy,) and the man providentially saved. The *Times* of yesterday contains an important letter on this subject from Mr. Clifford, in which he very pertinently says:—"Now, if a heavy man-of-war's cutter, with all its crew in it, could be thus instantly and safely lowered in one of the heaviest gales that ever broke upon our coast, we may at once infer how much more easily the same operation might be performed from a merchantman, where everything being on a less cumbrous scale necessarily entails less risk or liability to accident. But in how many of the ships, the harrowing recitals of the wrecks of which you have so repeatedly and so graphically chronicled of late, has anything of the kind been on board? Was the Royal Charter so provided, or do the owners of any of the hundreds of the huge passenger ships of her class that leave our shores ever give one moment's heed to such absolute necessaries? Let any one who doubts what I say take the trouble to go through our docks and inspect a few ships all duly passed 'as ready for sea.' He will not be long in finding that, in spite of laws putting a fine of from '£5 to £50 on the master of every passenger ship not having a longboat and a lifeboat fitted so as to be most available for immediate service (18th and 19th of Victoria, cap. 119), or the *Board of Trade Circular, No. 51*, January, 1857, that 'surveyors are to refuse declarations in future in cases in which the lifeboat is not in such a position as to be ready for use in an emergency, or in which efficient means are not provided for lowering it safely and expeditiously into the water;' I say, however incredible it may seem, yet he will not find one ship in a hundred that complies with these provisions, or any officer who, knowing them to be deficient, ever attempts to enforce such distinct and positive rules, the wanton disregard of which his superiors knowingly wink at."

A correspondent of the *Times* writes as follows:—There are three great difficulties attendant on the use of the "rocket" in the case of shipwreck or vessels in distress:—1. The uncertainty that necessarily attends its flight, especially in strong winds (times when it is most generally needed). 2. The impossibility virtually of its always being on the spot where required. 3. The impracticability of its rapid use on such parts of a coast as are rocky, marshy, &c. Query.—Would not all these difficulties be removed and many other advantages gained by the vessel itself carrying the rocket apparatus—a precaution quite feasible, at all events to large vessels? 1. The difference between the accuracy of its flight and that of the land rocket would be equivalent to the difference in the difficulty between hitting a centre of a circle from its circumference and the circumference from its circle. 2 and 3. Not only would it always be at hand and available, but it would be equally efficacious on the shores of a desert island as on the coasts of Kent; and, among many other advantages which suggest themselves, its fire flight in the air (at night) would indicate to coastguards, &c., the place where the rope was landed. This seems so simple as well as important an expedient that I can hardly believe that there can be any novelty in the idea. As, however, I have never heard or read of this application of the rocket system, I beg to forward you the suggestion, should you think it worthy of a place in your columns.

It is stated that the entire establishment composing the Royal Gun Factories in Woolwich Arsenal is about to be remodelled, an immediate cessation of casting guns of every description having been decided on, in order to give place to the introduction of Sir William Armstrong's method on the most extended possible scale. Sir William Armstrong and Mr. Anderson, conducting the rifled ordnance department at Woolwich, were on Saturday summoned to a lengthened conference with the Secretary of State for War, on the subject of transferring the whole of the Royal gun factories to that department which, it is expected, will be put into effect by official announcement without delay. The casting metal on hand, as well as the unfinished brass guns, are ordered to be handed over to the Laboratory to be appropriated to other uses. One of the experimental cast-iron ordnance, termed a shunting gun, rifled on Sir William's principle, has been tested at Shoeburyness, as we stated a week or two since, and burst under trial. This, together with other experiments entered into, has borne out the impression made on the minds of the Ordnance authorities, that cast ordnance are not of sufficient strength to resist the force exerted with the rifle bore, and that wrought iron alone is applicable for that purpose. The casting furnaces recently erected will be employed in the manufacture of shells and other purposes; and the Artillery officers connected with the department will return to their military duties.

The *Times* of yesterday adds the following information on this subject.—"The first step in advance towards the long contemplated reorganization of the important establishment composing the gun factories in Woolwich Arsenal was yesterday taken by handing over the direction of the department in due form from the military to the civil service, to be conducted in future under the auspices of Sir W. Armstrong, C.B., and the resident superintendence of Mr. John Anderson, late inspector of machinery. Great preparations are made for manufacturing rifled ordnance on Sir William's principle, calculated, according to present arrangements, to bring out, at the lowest computation, 1,000 guns a year, with the prospect of a considerable addition to that number, in case of actual demand. A number of cast-iron guns will be made in the factories and by the trade for experimental use, to be encased in a kind of net-work, termed a 'chemise,' composed of wrought-iron, which it is suggested will add to the endurance of the inner metal of which the gun is cast, and render it sufficiently strong for the purpose. The new department has received instructions to bring out as speedily as possible a batch of 40 6-pounder rifled guns to carry the elongated shot for field service in China, to be transported overland. It is stated that, as a necessary consequence of the whole of the gun factories being employed for the manufacture of Sir William's guns, the shot and shell foundries will be ultimately handed over to the same direction, and that the superintendence of the laboratory will merge into that of the gun factories, which will create a reduction of no insignificant importance in the general expenditure."

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 875.

BOILERS AND THEIR FURNACES, &c., 832, 866.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 842, 862, 867.

SHIPS AND BOATS, including their fittings, 843, 844, 845, 854, 860.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 868, 869, 870.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 839, 859.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 830, 835, 838, 847, 847, 849, 850, 855, 856, 865, 876.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 833, 836.

LIGHTING, HEATING, AND VENTILATING, 828, 852.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 841, 851, 858.

METALS, including apparatus for their manufacture, 826, 846, 848.

CHEMISTRY AND PHOTOGRAPHY, *None.*

ELECTRICAL APPARATUS, 837, 863.

WARFARE, 840, 864, 874.

LETTER PRESS PRINTING &c. *None.*

MISCELLANEOUS, 827, 829, 831, 834, 853, 857, 861, 871, 872, 874, 875, 877.

826. A. BESSEMER. "Improvements in furnaces to be employed in the manufacture of iron and steel." Dated April 2, 1859.

This consists in constructing furnaces for the manufacture of iron and steel with a portion of the bed thereof raised above the level of the remaining part of the bed, and in so mounting such furnaces that, by suitable machinery, the beds shall rock or perform an up and down motion, thereby causing the metal to be roused about and turned over. *Patent abandoned.*

827. S. DESBOROUGH. "Improvements in making up needles, steel pens, and other small articles for sale." Dated April 2, 1859.

The inventor takes a piece of paper, tin, &c., of suitable form, and by means of dies or tools he forms or impresses on the surface of such material a number of grooves, channels, or corrugations according to the number of needles the package is intended to contain, and he afterwards folds over those parts which are not impressed, and secures them, leaving one end of such series of grooves open to introduce the needles, that end being afterwards covered by a loose flap folding over. He introduces into each case, when being made, a thin strip of magnetized iron or steel, which will attract needles and prevent them falling out of the grooves. *Patent abandoned.*

828. J. SKERTCHLY. "Improvements in apparatus for regulating the pressure of gas." Dated April 2, 1859.

This consists, 1, in the construction of oscillating valves for regulating the supply of gas to the burner. These valves work in mercury, and are so arranged as to release on one side of their centres a corresponding amount of mercury to the displacement of the other. 2. In constructing a vertical section valve by means of a small inverted cup, with slots or openings at its edges. 3. In reducing the pressure of gas by causing it to percolate through any suitable depth or thickness of granulated material. *Patent abandoned.*

829. W. MATHER. "An improved apparatus for catching and destroying flies and other insects." Dated April 2, 1859.

This consists of shallow dishes or vessels of tin, zinc, or other metal, with holes or projections in the sides to allow of their being suspended from the ceiling, in which any of the well-known poisonous or adhesive substances used for such purposes is placed. *Patent abandoned.*

830. A. PAGET. "Improvements in machinery or apparatus for the manufacture of looped fabrics, and in the manner of constructing the same." Dated April 2, 1859.

This consists, 1, in using a sinker to each needle, and actuating each sinker consecutively by an incline or otherwise; also in a method of supporting the sinkers in a grooved bar or comb; also in a method of retaining each sinker in position by a spring; also in securing such springs to a bar by cement or solder. 2. In using a presser bar with garts or grooves for the sinkers to slide through. 3. In a method of producing a selvage on any needle in the frame by a thread-layer. 4. In a method of making a knocking-over-bar with the knocking-over pieces of steel plate, and of securing them in garts or grooves in a bar of brass. We cannot give space to the details of the invention. *Patent completed.*

831. M. SCOTT. "Improvements in diving apparatus." Dated April 2, 1859.

This mainly consists of the addition to the air pumps of an indicating cylinder containing a piston, the cylinder being open to the atmosphere at the top, and connected with the pump at the bottom by means of a pipe and stop-cock; the piston is loaded with weights which counterbalance the pressure of the air. *Patent abandoned.*

832. M. COUPLAND. "Improvements in furnaces." Dated April 2, 1859.

In furnaces wherein a part of the foil bars are made to rise, as the fuel is consumed, in place of the hand mechanism for raising or lowering such part or parts of the foil bars, the patentee applies hydraulic mechanism, or the pressure of steam. The moveable bars are actuated by levers which receive motion from the piston of a hydraulic cylinder. *Patent completed.*

833. T. RICHARDSON and G. W. JAFFREY. "Improvements in the arrangement and construction of harbours of refuge, breakwaters, sea walls, or barriers, and other like structures." Dated April 2, 1859.

This mainly consists of a line or series of tapered towers, cylindrical in transverse section, made of cast or wrought-iron, having a clear space between each equal to its diameter. The spaces are to be filled in with balks of timber, iron pipes, or tubes, so as to form a species of vertical lattice, or screen, to break the oscillation of the waves, but at the same time allowing the tides to flow freely through them. *Patent completed.*

834. T. WILLIAMS and J. H. FULLER. "Improvements in screw-stocks and dies." Dated April 2, 1859.

This consists in the adoption of two square dies, with a cutting surface on each edge, and a wedge at the back thereof, pressed down, drawn up, or propelled by certain arrangements. *Patent completed.*

835. F. POTTS and R. BROUGH. "Certain improvements in the manufacture of calico printing rollers or cylinders, also in the machinery and apparatus for performing certain parts of the same, and which said apparatus are also applicable, separately or conjointly, to the manufacture of parallel and other metallic tubes, and the rolling of the metal for the same, or other purposes." Dated April 4, 1859.

This invention comprises a variety of detail (as may be judged from the above lengthy title) which we cannot here quote at sufficient length for an intelligible abstract. *Patent abandoned.*

836. J. ECCLES. "Improvements in machinery for making bricks, tiles, and other articles formed of plastic materials." Dated April 4, 1859.

The object here is to prevent breakage or stoppage of the apparatus when by accident an obstruction gets into the pusher chamber by providing a plate so contrived as to slide or give way, and in combining rollers with machinery that shall crush and deliver the clay to the mill, and, moreover, force the material through the pug-mill to be expressed through the moulding orifices. *Patent completed.*

837. C. F. KIRKMAN. "Protecting telegraph wires, and in using them for subterranean and submarine purposes." Dated April 4, 1859.

This relates to a mode of constructing and applying telegraph wires, and consists in placing the wires covered with gutta-percha within a network, plaiting, or braiding of cocoa-nut fabric. *Patent abandoned.*

838. C. F. KIRKMAN. "Improvements in the manufacture of cocoa-nut fibre yarn and matting." Dated April 4, 1859.

This consists in spinning cocoa-nut fibre into yarn by means of well-known spinning machinery, and in afterwards manufacturing such fibre into matting by means of machinery. *Patent abandoned.*

839. W. BROWN and C. N. MAY "Improvements in hay-making machines." Dated April 4, 1859.

The inventor mounts the rakes or prongs for tossing the grass or hay on the same axis as the carrying wheels of the machine. On the frame in connection with the shafts they fix a ring with internal teeth concentric with, and in the plane of, a small pinion on the barrel or centre of the rake heads or prongs; they gear this pinion with the ring of teeth by means of three or other number of intermediate or idle wheels, which are mounted on studs fixed to a plate carried round by the carrying wheels, which thus communicates a quick motion to the rakes. *Patent abandoned.*

840. J. H. BURTON. "Improvements in the manufacture of barrels for small fire-arms." Dated April 4, 1859.

Here the patentee takes a short solid cylindrical bar of steel which he slightly anneals. Through the centre of its entire length a hole of sufficient size to allow for the proper contraction when the cylinder is elongated is drilled, and the piece heated to the degree required in rolling steel. It is next subjected to the action of corresponding taper grooves on the peripheries of a pair of rollers. The cylinder is presented to these rollers upon fixed mandrils, and by them the size of the hole reduced in the elongation is determined. The barrel is then bored, turned, and finished in the usual way. *Patent completed.*

841. W. E. NEWTON. "An improvement in ladies' hooped skirts." (A communication). Dated April 4, 1859.

This consists in constructing one or more of the hoops or springs of a skirt so as to preserve as far as necessary its inflexibility in an upward and downward direction in all parts except at a point or part on such side, where they are made flexible, in order that they may bend and allow the front portion to hang down over the front of the seat when the wearer is sitting down. *Patent abandoned.*

842. W. E. NEWTON. "An improved construction of retarding apparatus or break for railway carriages." (A communication.) Dated April 4, 1859.

The retarding apparatus which operates on the wheels is actuated by means of suitable gearing, connected with one of the axles of the running wheels, and this gearing is brought into action by means of a clutch box under the control of the guard, and is put in or out of gear by a screw shaft and lever. *Patent abandoned.*

843. C. RUSSELL. "An improvement in the working of marine engines." Dated April 4, 1859.

The patentee claims applying the vibrating motion of a pendulum (derived from the pitching of a steam vessel) for cutting off the steam during the descending pitch, through the intervention of a tappet shaft connected with the cut-off valve, which will ensure a sudden cut off. And in conjunction with this combination he claims the use of a race which will allow of the pendulum vibrating to a given extent, without operating upon the cut-off valve, and will ensure the efficient action of the pendulum when the pitching of the vessel exceeds the given limit. *Patent completed.*

844. M. A. CROOKER. "Improvements in paddle-wheels for steamers." Dated April 4, 1859.

This consists in graduating either the distance from the centre at which floats or buckets of equal size are set upon the wheel, or of proportioning the size, and of course the resistance of each individual float or bucket to the amount of effective power impressed upon the wheel at the time the float or bucket is passing through the water. *Patent completed.*

845. D. B. WHITE. "Improvements in arranging ships' and other pumps." Dated April 4, 1859.

According to this invention, when it is desired to raise water or other fluids from a lower to a higher level, over an intervening obstacle of greater elevation than the higher level of the water or other fluid, the patentee prefers to employ an ordinary lift pump which has combined with it a syphon-formed outlet pipe, which is carried up from the upper or other suitable part of the barrel of the pump over the obstacle above which the water or other fluid has to pass, and down again so as to dip below the water or other fluid at the higher level. *Patent completed.*

846. E. MOREWOOD. "Improvements in coating metals." Dated April 4, 1859.

The patentee claims the sheeting of iron or copper by causing them to pass a certain number of inches below the surface of the coating metal. Also, the use of a box or arrangement for dividing the surface of the coating metal so as to have one kind of flux in one side of the sheets, &c., to be coated, and another or no flux at all on the other side. He also claims other features more or less connected with the above. *Patent completed.*

847. D. SOWDEN. "Improvements in Jacquard machines employed for weaving figured goods or fabrics." Dated April 4, 1859.

This consists in imparting motion to the bottom bard and groove of jacquard machines by means of two rods or slides, and one lever and one treading rod, which simplifies the working and gains increased thereof. *Patent abandoned.*

848. A. SHANKS. "Certain improvements in machinery for forging and stamping metals." Dated April 5, 1859.

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The patentee claims, 1, the constructing of steam-hammers of forging machines operated by a rotary movement to work the valve or valves in lieu of cams or levers. 2. The use of two extra valves, to regulate independently the pressure of steam on either side of the hammer piston. 3. The forming of the piston rod part of the hammer into an elliptical shape, to prevent its turning round in the cylinder; also, the placing of an elastic buffer inside the cylinder for the piston to strike against. *Patent completed.*

849. G. HASELTINE. "Improvements in sewing machines." Dated April 5, 1859.

This consists in making a fast or knot-stitch, in addition to the ordinary shuttle stitch, by a simple construction and peculiar arrangement and combination of parts. The invention is not described apart from the drawings. *Patent completed.*

850. E. FAIRBURN. "Improvements in machinery for carding wool and other fibrous substances." Dated April 5, 1859.

This relates to a former patent, dated March 11; 1852, and consists in placing plates of thin metal betwixt the swift or carding cylinder and the doffer, such plates being fitted and fixed in position with one edge in close proximity to the surface of the swift, the other edge entering into narrow grooves formed or cut into the surface of the doffer at suitable distances, so that the cards on the doffer are thus formed into rings, which being separated by the plates at the point of contact with the swift of the wool, &c., is effectually divided into strips as it is transferred from the swift to the doffer, from which it is stripped and passes over grooved rollers to the rubbers. *Patent completed.*

851. L. BRIERLEY and H. GEERING. "A new or mproved method of ornamenting metallic bedsteads and other articles of metallic furniture." Dated April 5, 1859.

The patentees claim ornamenting such articles by applying thereto designs upon paper, the said designs being either drawn, engraved, lithographed, printed, or otherwise produced, and either plain, coloured, gilt, or bronzed and applied to the article by a mixture of glue and paste, and afterwards varnished, stoved, and polished. *Patent completed.*

852. F. C. BAKEWELL. "Improvements in open fire-places." (A communication.) Dated April 5, 1859.

The patentee claims the use of a recess or fire-chamber placed at the back of the fire-basket of the grate, in combination with a covering, either arched or flat, placed over the recess and fire basket, extending below the throat of the chimney for better consuming the smoke and gas emitted from the fuel. *Patent completed.*

853. G. F. CHANTRELL and E. DUTCH. "Improvements in the apparatus for regulating the quantity of water to be used for the flushing of water-closets and other purposes." Dated April 5, 1859.

This consists in the use of a water supply cistern having a double bottom forming a measuring chamber for containing the quantity of water required at each operation of the apparatus. Within the measuring chamber is placed a double-acting valve, which upon being elevated or depressed cuts off the supply opening between the cistern and the measuring chamber, and opens the discharge orifice formed in the bottom of the measuring box, and upon the action being reversed the supply valve is opened, and the discharge orifice closed. This double valve is acted upon by a system of levers, which levers receive their motion by a person entering the closet or otherwise. *Patent completed.*

854. B. BROWNE. "Improvements in propelling ships or other vessels through water." (A communication.) Dated April 5, 1859.

This relates to screw propellers, and consists principally in placing them very much before the stern-post of the ship, and well under the bilge thereof, so that the power will be greater, and acting more directly upon that part of the vessel will assist in giving her more speed and less vibration. It is proposed to employ double screws, or two screws or segments on shafts at each side of the stern-post, the said shafts being worked by any motive power. *Patent abandoned.*

855. J. HETHERINGTON, T. WEBB, and J. CRAIG. "Improvements in machinery or apparatus for spinning and doubling cotton, and other fibrous materials." Dated April 5, 1859.

The patentee claims, 1, driving the spindles by conical friction surfaces. 2. The use of apparatus for causing the cords to lap around, and to retire from the drag pulleys. 3. The use of slits formed in the flyers or tops of spindles, in conjunction with top bearings, also with slits; also the use of spiral top ends to flyers or spindles. 4. The use of two or more loose and fast wharves on one spindle. *Patent completed.*

856. T. SCOTT. "Improvements in preparing, treating, or manufacturing fibrous materials, and in apparatus employed therein." Dated April 5, 1859.

This relates principally to the treatment of "China grass." or "rhea fibre." The material is primarily deposited in a chamber containing a cold or heated alkaline solution, composed of alkali and soap, or oleaginous matter and common soda, or soda and potash. After treatment in this solution the fibrous material is removed, and it is then laid in a heap for the gummy matter to become separated from the actual fibre. The fibre is then beetled, washed, and finished for hackling in the ordinary way. There are modifications included. *Patent abandoned.*

857. N. LIBOTTE. "An improved safety apparatus to be applied to cages in the drawing of coals." Dated April 5, 1859.

This consists of a safety apparatus in which claws, grips, or jaws are mounted upon shafts which are capable of being turned to the required extent by means of vertical or horizontal springs on such springs being released by the breaking of the rope or chain by which the chair is suspended. The springs being thereby set free to act upon the shafts and their jaws or grips, the latter are caused to grip or catch into the pit or shaft guides with a firm hold. *Patent completed.*

858. F. M. CRICHTON. "Improvements in clocks or time-keepers." Dated April 5, 1859.

This consists in a new arrangement of what is usually termed a "going barrel," or toothed spring box, applying the power of one only to work both trains. *Patent completed.*

859. T. P. LUFF. "Improvements in cheese-vats." Dated April 6, 1859.

This consists in making those vessels in which cheeses are pressed of metal instead of wood. The inventor makes them of the usual form, with loose shifting bottoms, and with discs or followers to be laid on the top of the cheese, and more or less perforated as required. *Patent abandoned.*

860. J. ADAMS. "An improved tubular chain cable guide for vessel's bulwarks." Dated April 6, 1859.

This consists in an improved manufacture of cable guide as made with its body or pipe curved in longitudinal section, the external surface of the flange being made in continuation of the curve of the body, and so that the chain whether running out or being drawn in shall pass over and on a curved surface, such as will prevent any link from being stopped so as to be broken. Such curve of the flange and the inner surface of the pipe will also operate to diminish the danger of breakage of a chain cable while the vessel held by it may be riding at anchor in stormy weather or while pitching on the waves. *Patent completed.*

861. J. A. H. BALLANDE. "An improvement in the preparation of writing-paper, and ink to be used thereon." Dated April 6, 1859.

This consists in introducing into paper oxides or metallic salts, the proportions of which may vary according to the intensity of effect to be produced. The agent preferred is proto-chloride of mercury, but any salt of iron, of copper, or any other metallic salt will answer. *Patent abandoned.*

862. W. OWEN. "Improvements in the manufacture of railway wheels and tyres, and in the apparatus employed therein." (Partly a communication.) Dated April 6, 1859.

This relates, 1, to a method of combining the felloes and the tyres, or any other parts of railway wheels, and consists in forming a dovetailed or other like hole groove or recess in the tyre or other of the two parts to be combined, and in forcing into this hole groove or recess the heated end of a rivet or bolt, or the heated edge or end of a bar or plate, so that the metal shall be expanded in the said hole, groove, or recess, and thereby be caused to hold the parts firmly together. It relates, 2, to improved methods of, and apparatus for, forming and combining the several parts of railway wheels and their tyres. According to one method the patentee forms the felloes of the wheels with parts of two different diameters, or with alternate portions of the periphery of two different radii, and also by preference of a dovetailed form. The tyre of the wheel is formed with a corresponding dovetailed groove all round its interior, and with parts of its internal edge cut away so as to allow of the large alternate portions of the felloe being dropped into the recesses in the tyre, and then to be turned round in the tyre so as to lock themselves in the dovetailed groove. This brings the alternate small portions of the felloe opposite to the recessed portions of the tyre, and the vacant spaces thus left are filled up by plates of a suitable shape which may be rivetted to the felloe. Again, in order to facilitate and improve the manufacture of railway wheels by means of dies under a powerful hammer, the patentee forms the parts which are to form a nave (by stamping in dies or otherwise) with sloping or inclined projections to receive corresponding ends of spokes, and in some cases he also recesses the nave, and forms the spokes with projections to fit in the recesses. The object is to provide either for heating all the parts at once, or for heating any two or more of them separately, and then bringing them together in a heated state to be acted upon by the hammer dies. There are various other features comprised in this invention, but to which we cannot specially allude for want of space. *Patent completed.*

863. J. ROGERS and E. J. TWRED. "Improvements in coating conducting wires used for electric telegraphic purposes." Dated April 6, 1859.

Here the conducting wire or wires are first coated with gutta-percha or india-rubber, and longitudinal bands of braided or plaited hemp are applied so as to surround the insulated wire or wires, and these longitudinal bands may be bound round with yarn or not to retain them, and then a coating of wires which have been previously bound with hemp or flax are braided or plaited over the outer surfaces of the parts previously combined. *Patent completed.*

864. J. SCOFFERN. "Improvements in lubricating projectiles and cartridges." Dated April 6, 1859.

This consists in employing for this purpose a composition prepared by mixing together paraffine and naphthaline. *Patent completed.*

865. D. MOSELEY. "Improvements in the manufacture of cards for carding cotton and other fibrous materials." Dated April 7, 1859.

This consists in manufacturing the backs of cards of cloth composed of woollen weft and cotton or linen warp covered with a sheet of india rubber in its native state cut from a cylindrical block. The sheet of native india-rubber is attached to the fabric by cement. *Patent completed.*

866. A. CHAPLIN. "Improvements in steam-boilers." Dated April 7, 1859.

This consists, 1, in constructing boilers with tubes crossing the water surface line, such tubes being contracted below such line, and re-expanded. 2. In combining in boilers tubes of different effective calibres, so as to obtain more equal currents throughout the series. 3. In constructing vertical tubular boilers with increasing horizontal area internally, at and immediately above the water surface line. The invention is not fully described apart from the drawings. *Patent completed.*

867. R. POSTLETHWAITE. "An improvement in harness pads for horses." Dated April 7, 1859.

This consists in fitting such pads with hinges made of one piece with, or firmly fixed to, the metal frame on which the said pads are made in order to render them flexible, and thus allow of their expansion or contraction when required for a different sized animal. *Patent completed.*

868. R. WARDELL and H. KEARSLEY. "Improvements in reaping machines." Dated April 7, 1859.

This relates to a former patent, dated April 1, 1857, and comprises several improvements which are not described apart from the drawings. *Patent abandoned.*

869. G. CHAMPNEY. "Improvements in reaping machines." Dated April 7, 1859.

Here the corn is cut by a series of circular saws driven by straps and pulleys from a suitable driving spindle in the body of the machine. The cut corn falls on to an endless inclined travelling sheet which conveys it from the cutters towards the hind portion of the machine where a receiving box or "tyne" is placed into which the corn collects. *Patent abandoned.*

870. J. LAKIN, jun. "A new or improved agricultural drill." Dated April 7, 1859.

The essential feature of this invention is a vibrating spout which delivers the manure by a side-long delivery. *Patent abandoned.*

871. J. GARRETT. "Improvements in the construction of goblets, jugs, and other like articles." Dated April 7, 1859.

This consists in mounting the bowl in a setting of metal which will thus be protected from liability to injury, and may be readily removed to facilitate the cleaning of the bowl. This metallic portion constitutes the foot and handle, and the bowl is secured by making it fit at bottom on to a projection or into a holder in the metallic foot, and causing the upper part of the handle (which is connected to the foot) to clip the edge of the bowl. *Patent completed.*

872. J. RAWLINGS. "An improved construction of boot-tree." Dated April 7, 1859.

The patentee constructs a boot-tree capable of contracting to receive the boot, and of being expanded and retained in that position while the boot is being cleaned. This boot-tree is fastened to any fixed point. *Patent abandoned.*

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873. J. T. PITMAN. "Improvements in the construction and use of fireworks for signals." (A communication.) Dated April 8, 1859.

This invention is not described apart from the drawings. *Patent completed.*

874. W. H. SMITH. "Improvements in the construction of cartridges, and in fire-arms for using the same." Dated April 8, 1859.

This consists in making a cartridge with several compartments in which the powder is deposited; these are separated from each other by interposing discs of metal so that the powder shall ignite and explode in each compartment in succession, and give successive impulses to the missile. It also consists in constructing the interior of the barrel with cutting or sunken grooves of different depths, but in the same continuous line, the deepest being at the breech. At a proper distance the depth diminishes, and so on successively as many times as there are chambers in the cartridge for the purpose of receiving the ends of these projections, and allowing them to proceed their intended distance without obstruction. The depth of the groove being lessened at a given point raises a barrier against which the wings strike, and the percussion powder is exploded, igniting the powder in the next chamber. *Patent abandoned.*

875. J. BINDLEY and J. L. HINKS. "Improvements in rotatory steam-engines and pumps, a portion of which improvements may also be applied to the bearings of shafts or axles, and other rotating bodies." Dated April 8, 1859.

The patentee claims, 1, a rotatory steam-engine or pump consisting of two concentric drums, the annular space between the said drums being closed on one side by a rotating vane carried by the smaller of the two drums, the steam or water being admitted and cut off by the descent and ascent of a slide valve, the ascending motion of which slide-valve is affected by the same, and the descending motion by its own weight. 2. Making the bearings of rotatory steam-engines and pumps in four pieces, the said pieces being made to contract upon the neck of the shaft by the action of wedges and screws. *Patent completed.*

876. W. CAMPION. "Improvements in machinery for the manufacture of looped fabrics." Dated April 8, 1859.

This consists in the arrangement and combination of a moveable needle bar and needle presser and looped hooks and sinkers and thread carriers, which are moved by cams and by which greater speed is obtained than heretofore. *Patent completed.*

877. W. WHEELDON. "An improvement in looking-glasses and mirrors." Dated April 8, 1859.

The object here is the ornamenting and increasing the reflective powers of looking glasses and mirrors, and consists in frosting, roughing, or obscuring, and cutting or carving an ornamental border on one or both sides of the plate, and afterwards silvering the same on the side on which the design is produced. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Aug. 31, 1859.

1982. G. S. Fleming. Improvements in candles for the purpose of indicating time, and the facility of lighting the same.

Dated Sept. 26, 1859.

2178. G. Addenbrooke. Improvements in raising and lowering boats and other vessels from one water level to another, applicable in inland navigation.

Dated Sept. 28, 1859.

2198. E. T. Simpson. Improvements in apparatus for condensing distilled fatty matters.

Dated Oct. 6, 1859.

2274. E. O'Connell. Improvements in apparatus for supplying liquid nourishment to infants, invalids, and others, and for warming or heating the same.

Dated Oct. 7, 1859.

2288. J. Dixon. Improvements in apparatus for supplying water to water-closets.

Dated Oct. 10, 1859.

2302. G. Davies. Improvements in the manufacture of paper, pasteboard, and cardboard. (A communication.)

Dated Oct. 13, 1859.

2332. A. and J. Holden. Improvements in machinery used in washing, dyeing, sizeing, and drying yarn and thread.

2334. W. Prosser. Improvements in apparatus employed in the production of light.

2336. W. Burgess. Improvements in reaping and mowing machines.

Dated Oct. 14, 1859.

2339. C. Collins. Improvements in the manufacture of grease for lubricating the axles of railway and other carriages, the journals of machinery, and for other like purposes. (A communication.)

2342. J. P. Henderson. Improvements in stop cocks or valves.

2343. G. Price. Improvements in locks.

2344. J. Varley and J. Crowther. Improvements in steam-engines and boilers.

2346. G. Goldsmith. Improvements in gas meters.

2348. H. W. C. Wise. An improved domestic apparatus for making tea, coffee, and other such like beverages.

Dated Oct. 15, 1859.

2350. H. Chapman. An improved self-acting safety railway break.

2352. J. Fernihough. Improvements in the construction of steam-boilers and apparatus connected therewith.

2354. J. H. Johnson. Improvements in machinery or apparatus for breaking stones. (A communication.)

2358. N. Montanari. An improved apparatus for aiding children in learning to walk.

2360. J. Elder. Improvements in steam and other engines.

Dated Oct. 17, 1859.

2362. W. K. Hall. Improvements in apparatus for manufacturing cotton wadding. (A communication.)

2364. S. Newberry and H. Moore. Certain improvements in looms for weaving.

2366. W. E. Newton. Improvements in rotary steam-engines. (A communication.)

2368. W. Norton. Improvements in kilns for drying grain.

2370. J. Thom and A. Kennedy. Improvements in looms for weaving.

2372. R. A. Brooman. Improvements in electro-magnetic engines, and in apparatus connected therewith. (A communication.)

2374. W. Tillie. Improvements in sewing machines.

Dated Oct. 18, 1859.

2378. A. W. Williamson. Improvements in obtaining extracts from poppies.

2380. J. Higgins and T. S. Whitworth. Improvements in machinery or apparatus for preparing and spinning cotton and other fibrous materials.

2382. W. E. Newton. Improvements in machinery used for spinning silk, wool, or other fibrous substances. (A communication.)

2384. H. Hirsch. A new propeller for ships.

Dated Oct. 19, 1859.

2386. J. H. Banks. Improvements in machinery for boring, cutting, moulding, and carving wood, stone, and other materials.

2392. C. Seton. Improvements applicable to the wheels of carriages generally for the purpose of reducing the draught thereof.

2394. G. Hart. Improvements in the manufacture of hats.

2396. J. and H. Bruckshaw and W. S. Underhill. Improvements in machinery for elevating grain or other similar substances.

Dated Oct. 20, 1859.

2400. E. T. Hughes. Improvements in machinery or apparatus for compressing and making caps for cartridges. (A communication.)

2401. R. A. Brooman. A cryptographic machine or apparatus for carrying on secret correspondence. (A communication.)

2402. P. A. Godefroy. Improvements in the construction of submarine cables.

2403. F. Nivelle. Improvements in sewing machines.

2404. J. Hodgson. Improvements in building ships and vessels.

2405. C. Hanson. Improvements in fire-arms and ordnance.

Dated Oct. 21, 1859.

2406. J. Musgrave. Certain improvements in steam-boilers.

2407. J. H. Green. A composition for coating metals and other substances for various purposes.

2408. J. T. Pitman. An improved mode of converting cast iron into soft malleable iron without change of form. (A communication.)

2410. G. T. Bousfield. Improvements in apparatus for steering vessels. (A communication.)

2411. T. S. Prideaux. Improvements in the construction of ships and rafts.

2412. W. Maltby. Improvements in refining oil.

Dated Oct. 22, 1859.

2414. P. Jones. Improvements in machinery or apparatus for suspending, carrying, and laying-down paper, woven fabrics, paper-hangings, and all kinds of flexible materials during and after the process of drying and also for giving a continuous positive motion to the suspending rods or spindles.

2415. G. B. Mill. Improvements in pressure-regulating apparatus for gas burners.

2416. W. Fox and J. Willis. Improvements in the manufacture of umbrellas and parasols, part of which improvements is applicable to other purposes.

2417. R. A. Brooman. A method of preparing inoxidizable oils and fats to be employed as lubricating substances. (A communication.)

2418. W. Brookes. Improvements in machinery or apparatus for preparing wool and other fibrous materials. (A communication.)

2419. S. Beardmore. Improvements in electric telegraphs.

2420. W. Thorold. Improvements in apparatus applied to locomotive engines for condensing steam.

2421. J. Dahlke. Improvements in the preparation of charcoal and its application to the purification of water and the preservation of organic matters, and in apparatus connected therewith.

2422. F. Wrightson. Improvements in purifying coal gas, and in utilizing compounds obtained in purifying coal gas.

2423. F. N. Clerk and C. Thomas. Improvements in clevers and choppers.

Dated Oct. 24, 1859.

2424. A. L. Dowie. Improvements in gas burners, and in pressure-regulating apparatus for the same.

2425. G. Holden. Improvements in machinery for spinning cotton and other fibrous substances.

2427. A. C. Bertrand. Improvements in the manufacture of herbal cigarrettes.

2428. R. A. Brooman. Improvements in daylight and other reflectors, and in the method of supporting lamp reflectors. (A communication.)

2429. M. Fitzpatrick. Apparatus to be applied to the prevention of accidents on railways, called "parachoc."

2430. R. Seager. Improvements in compounds of india-rubber and gutta-percha.

2431. W. E. Newton. Improvements in the construction of ships or vessels. (A communication.)

2432. W. E. Newton. Improvements in paddle-wheels. (A communication.)

Dated Oct. 25, 1859.

2433. H. S. Rosser. Improvements in electric telegraph cables, and in the mode of obtaining signals.

2437. W. A. Matthews. Improvements in springs.

2439. E. Ellis. Improvements in the manufacture of lace, and in apparatus employed therein.

2441. E. S. Tebbutt. An improved manufacture of elastic fabrics.

Dated Oct. 26, 1859.

2443. W. Clark. Improvements in the preparation and application of baths or bathing media, and in apparatus employed therein. (A communication.)

2445. J. Z. Kay. Improvements in gas meters and in apparatus for maintaining or preserving the levels of liquids.

2447. J. H. Paterson. Improvements in shirting cloths and in shirts.

2451. C. E. Wilson and H. G. Hacker. Improvements in machinery for the manufacture of chenille.

2453. T. Whitby and W. Dempsey. Improvements in ordnance and fire-arms.

Dated Oct. 27, 1859.

2455. C. Stevens. A machine for scouring and polishing floors and decks of ships. (A communication.)

2457. E. H. Rascol. A new implement for cleansing of the plates, dishes, and other table or kitchen utensils. (A communication.)

2459. R. M. Ordish. Improvements in railway fastenings.

2461. R. A. Brooman. Improvements in the preparation of red colouring matters or dyes. (A communication.)

2463. H. Cowan. An improvement in waistcoats and certain other articles of wearing apparel.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Nov.* 8, 1859.)

1528. J. Roberts. Filters.

1533. G. and T. H. Wrigley. Self-acting mules.

1543. G. Hall, jun. Reaping machines.

1545. W. and J. Wray. Reaping machines.

1546. T. Wight. Cast metal pipes.

1553. E. Francis. Packing grocery.

1558. L. Boigeol. Twisting fibres.

1579. R. W. Morville. Window sashes. (A communication.)

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1589. H. C. and J. C. Howells. Registering the number of passengers.
1593. J. McIntosh. Driving belts.
1596. A. Beaulieu. Crinolines. (A communication.)
1607. L. Schwartzkopff and F. C. Philippson. Steam hammers.
1612. F. A. Le Mat. Ordnance.
1614. R. C. Rapier. Rolling plates.
1618. J. H. Johnson. Knitting frames. (A communication.)
1620. W. H. Dawes. Iron.
1622. F. A. Le Mat. Fire-arms.
1636. M. Henry. Overshoes. (A communication.)
1660. W. Cotton. Looped fabrics.
1664. R. Mushet. Projectiles.
1665. R. Mushet. Metallic alloys.
1674. R. Mushet. Metallic alloy.
1707. Earl of Caithness. Permanent way.
1747. E. Hunt and H. D. Pochin. Resin.
2069. E. J. Mallett. Axles.
2152. R. Davidson. Holders for liquid or air.
2176. R. Kay. Textile fabrics.
2181. W. Airey and J. Clayton. Preparing for spinning.
2251. J. Thompson and J. Thompson, jun. Salt.
2263. W. E. Newton. Fire-arms. (A communication.)
2314. A. V. Newton. Clarifying saccharine solutions. (A communication.)
2318. W. Day. Rotary steam-engine.
2323. T. Rothwell. Well-holes.
2343. G. Price. Locks.
2362. W. K. Hall. Wadding. (A communication.)
2411. T. S. Prideaux. Ships and rafts.
2419. S. Beardmore. Electric telegraphs.
2441. E. S. Tebbutt. Elastic fabrics.
2445. J. Z. Kay. Gas meters.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Nov. 4, 1859.

1039. H. C. Hurry.
1122. H. Turner.
1131. H. Reynolds.
1132. R. A. Brooman.
1137. W. Kellingley.
1138. F. Angerstein. R. Clegg, and G. Thorrington.
1142. T. Jones.
1154. W. E. Gedge.
1156. W. Jeffery.
1163. A. Morton.
1164. E. T. Hughes.
1165. T. Green, jun.
1169. W. Wilkinson and C. Whitley.
1170. M. Defries.
1171. J. Norman.
1172. R. Thomson.
1173. G. Bell.
1182. H. Clarke.
1187. J. Leadbetter and J. Rhodes.
1190. J. Saxby.
1191. R. A. Brooman.
1205. J. T. Beale and T. N. Kirkham.
1213. J. Chatterton.
1229. R. Romaine.
1247. J. H. Johnson.
1259. E. Pasquier.
1288. D. S. Price.
1331. O. Maggs.
1358. W. H. Parkes and W. Bagnall.
1361. J. Wilson.
1390. R. Barclay.
1407. M. J. Haines.
1501. C. Clarini.
1748. A. Sidebottom.
1759. J. Wright.
1972. G. Collier.
1990. E. Ellis.
2081. H. G. Collins.
2131. P. Fairbairn.

Sealed Nov. 8, 1859.

1196. T. Scott.
1200. R. Gourlay.
1207. J. M. Munro.
1208. M. Leahy.
1296. J. Howard.
1306. J. Draper.
1374. R. Chrimes.
1569. N. Ardaseer.
1649. W. MacKean.
1645. H. Davies.
1915. W. A. Vérel.
2080. J. Mason.
2089. W. E. Newton.
2109. W. E. Newton.
2111. H. Jackson.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2576. S. Tearne and G. W. Richmond.
2577. J. Nasmyth and R. Wilson.
2585. H. Bessemer.
2593. W. Weibl.
2596. C. Titterton.
2605. W. Seed and W. Ryder.
2617. R. A. Brooman.
2625. L. J. V. Vuitton.
2624. C. W. Siemens.
2631. J. L. Clark.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

590. W. Petrie.
624. E. Lord.
643. A. L. Knox.
650. J. Wotherspoon.
656. Earl of Dundonald.
683. J. J. Ziegler.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Nov. 4, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
762	0 3	791	0 3	801	0 10	811	0 7	8211	5	8320	10
766	0 3	792	0 4	802	0 6	812	0 7	822	0 6	833	0 7
773	0 3	793	0 3	803	0 3	813	0 7	825	0 3	834	0 6
782	0 3	794	0 3	804	0 3	814	0 3	824	1 0	835	0 3
783	0 3	795	0 7	805	1 0	815	0 3	825	0 3	836	0 19
784	0 3	796	0 3	806	1 0	816	0 3	826	0 3	841	0 3
787	0 3	797	0 9	807	1 1	817	0 3	827	0 3	843	0 10
788	0 10	798	0 6	808	0 3	818	0 5	828	0 3	846	0 7
789	0 10	799	0 3	809	1 1	819	0 4	829	0 3	851	0 3
790	0 10	800	0 7	810	1 5	820	0 3	831	0 3	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

BALLAST LIGHTERS AND BARGES, *Trinity House.*—For the building and repairing of the ballast lighters and barges belonging to the Trinity House. The necessary printed forms, and every particular, at the Ballast Office, Trinity House, where tenders, November 14.

DREDGING MACHINE AND SCREW HOPPER BARGES, *Newcastle.*—For the construction of a dredging machine and three hopper barges for the Tyne Improvement Commissioners. Plans and specifications at the engineer's offices, Town Hall-buildings, Newcastle-upon-Tyne. Tenders addressed to the chairman of the commissioners, on or before Dec. 13.

CORPORATION WATERWORKS, *Bradford.*—The Waterworks Committee of the Bradford Corporation will meet at their offices in Bradford, on Tuesday, the 29th of November, at 11 o'clock, a.m., for the purpose of receiving tenders or proposals for the following works:—The excavating for building and completing of a portion of the main aqueduct or conduit for conveying water to the town of Bradford, commencing at Sandbed Beck, in the township of Burnsall and terminating at the south end of a certain tunnel now in course of construction called Baden tunnel, in the township of Baden, with a certain branch conduit in the township of Draughton, such conduits being of the aggregate length (including the laying of certain iron pipes for supplying the village of Burnsall and about 675 yards of 24-inch pipes for crossing the valley of the Baden Beck) of about 7¼ miles. Plans and specifications, &c., of Mr. John W. Leather, civil engineer, Leeds.

REFORMATORY, *Dalby, near Doncaster.*—For the works necessary in the erection of the West Riding Reformatory for Girls. Drawings, &c., to Mr. Haughton, Hyde Park, Doncaster. A large quantity of building materials on the site will have to be taken by the contractor, and used as far as applicable in the proposed buildings. Tenders to Nov. 23.

SCUTCHING ROOM, *Bolton.*—For the erection of a scutching room, a mixing place, and a warehouse at Belmont Mills. Plans, &c., Mr James Lomax, surveyor, 8 Fold-street, Bolton. No date given.

COALS, *Navy.*—For 2,000 tons of South Wales coals monthly, to be delivered into store at Her Majes y's Naval Yard at Malta for six months from 1st December. The commissioners having the power to increase the monthly proportion to be shipped after 1st January next to any quantity not exceeding 4,000 tons in each month, if required, on one month's notice to the contractor. Conditions of contract and form of tender may be seen at the office department at the Storekeeper General of the Navy, Somerset-place. Tenders must be addressed to the Secretary of the Admiralty, and delivered at Somerset-place, accompanied by a letter signed by two responsible persons, engaged to become bound with the person tendering in the sum of £5,000. Tenders and attendance 15th inst. at 2 o'clock.

COAL, *East India Company.*—For the supply of 3,000 tons of coal for steam navigation, to be delivered into store at Madras. Tenders, to 22nd November, or forms to be had at the Marine and Transport Department in the India office, they must be left at the Secretariat office.

COAL, *India Board.*—To supply 3,000 tons of coal for steam navigation to be delivered at Bombay, or any of the under-mentioned sorts, viz.:—West Hartley, Longridge's West Hartley, Byat's Bedside West Hartley, Ravensworth West Hartley, Joannassoan's Hartley, Hastings' Hartley, Stewart's Wallsend Steam, Hartlepool West Hartley, or Samuelson's real old Gamber (Oak's colliery) Hard Steam Coal. Forms of tender to be had at the Marine and Transport Department in the India office, with conditions annexed. Tenders, before 11 forenoon, Nov. 15, at the Secretariat office.

DUST CONTRACTORS, *St. Giles, Cumberwell.*—For the purchase, collection, and removal, of all the ashes, cinders, rubbish, dust, breeze, refuse, filth, soil, &c., in the several roads of the above parish, between Dec. 1, 1859, and November 30, 1860. Separate tenders for each of the six wards. The necessary draft, contract, and bond, to be seen at the Vestry Clerk's office, Vestry Hall, Camberwell. Tenders at the Hall, Nov. 14. Personal attendance necessary; and the successful tenderer must deposit £5.

ROADS, *Worcester.*—For making the intended new roads over about seven acres of land at the top of Barbourne-terrace, and laying down the culverts connected therewith. Plans, &c., and condition at the office of Mr. Henry Day, surveyor, Foregate-street, Worcester. Tenders to Nov. 12.

ROADS, *Waterhead to Westmoreland, Ambleside.*—For the widening, improving, and diverting the road leading from Waterhead to the south entrance of the town of Ambleside. Plans, &c., the office of Mr. Webster, land surveyor, Rindal, who will meet intending contractors on the ground at 10 a.m., on Wednesday, Nov. 16, to point out the works and receive tenders, which must be in writing and under seal. The plan may be seen on application to Mr. Thomas Baldersion, Ambleside.

SURVEY, *Barnsley Union.*—The guardians are desirous of contracting with two gentlemen, not being partners, for a new valuation (to be made in conformity with the Parochial Assessment Act) of the whole of the houses and property, mills, manufactories, collieries, gas-works, water-works, railways, and canals, in the township of Barnsley. And the guardians wish to contract with one valuer for a new valuation of the land in the said township. A recent survey has been made of the township, and the map may be used so far as the same may be applicable and correct. Contractors may tender either by commission, or for a fixed sum. The township contains about 2,200 acres of land, and 3,775 houses, warehouses, and other buildings. Tenders and testimonials to Mr. John Tyas, Clerk to the Guardians, to Nov. 21.

RAILWAY DRAUGHTSMEN.—For the Cape Town Railway and Dock Company. One experienced in station work, and the other in wrought and cast-iron work, are required by this company to sail for the Cape by the mail of the 6th December next. Applications, with copies of testimonials, and stating terms, to Mr. G. Latham Browne, managing director, 261 Gresham House, Old Broad-street.

TRAVELLER TO WIRE DRAWER.—One acquainted with the trade, and of good address, will be liberally dealt with. When not engaged in travelling, his services will be required in the counting-house. Applications personally or in writing, to Mr. John Caw, accountant, Halifax; or Messrs. Shackles and Sons, solicitors, Leeds.

TRAVELLER FOR A PLATE GLASS MANUFACTORY.—State where last employed, and the terms required. Address, Box L., 20 Post-office, Manchester.

TIN-PLATE WORKERS.—Eight or ten first-class men. Constant employment and good wages to steady men. Apply to Mr. T. Wright, Victoria Tin Works, Sackville-street, Manchester.

GAS WORKS MANAGER.—A person to take the entire charge of the Morecambe Gas Works, near Lancaster. His duties will be to undertake the manufacture of gas, lay down main and service pipes, and fixing meters, and other matters appertaining to works of this description. He will have a house on the premises rent free, and firing and gas. Applications with testimonials, and stating terms, to Mr. William Whiteside, secretary to the above company.

EXPERIENCED HANDS.—To fix galvanized corrugated iron, self-supporting, and other kinds of iron roofs. Address, with full particulars to previous engagements and references, M., 47 General Post-office, Liverpool.

FORGE MANAGER.—Application by letter, with full particulars of qualifications, age, and expectations, to Mr. Roberts, care of Messrs. Horn and Story, Grey-street, Newcastle-upon-Tyne.

PRICES CURRENT OF METALS.

London, Nov. 11th, 1859.

		£ s. d.		£ s. d.	Dis.
IRON:					
Rails in Wales and North of England	pr.ton	6 0 0	to	6 5 0	cent
Welsh Bars, in Wales	,,	5 17 6	,,	6 0 0	5
Staf. Bars, at the Works	,,	7 0 0	,,	7 10 0	2½
,, Hoops	,,	8 0 0	,,	9 10 0	,,
,, Sheets, Singles	,,	8 10 0	,,	9 0 0	,,
,, Nail Rods	,,	7 0 0	,,	7 10 0	,,
,, Boiler Plates	,,	8 10 0	,,	9 0 0	,,
Scotch Pig, M. Nos. Warrants, at Glasgow	,,	2 11 6	,,	2 11 9	nett
Do. No 1, Good Brands	,,	2 12 0	,,	2 14 3	,,
Scotch Bars	,,	7 10 0	,,	8 0 0	2½
Swedish Bars, in London	,,	11 10 0	,,	11 15 0	2½
COPPER:					
Sheet and Sheathing	per lb.	0 0 12	,,	0 0 0	3
Tough Cake and Tile	pr.ton	107 10 0	,,	0 0 0	
Best Selected	,,	110 10 0	,,	0 0 0	,,
Australian	,,	109 0 0	,,	110 0 0	,,
South American	,,	99 0 0	,,	101 0 0	nom
Yellow Metal Sheathing	per lb.	0 0 10	,,	0 0 0	,,
STEEL:					
Swedish Keg	pr.ton	19 0 0	,,	19 10 0	2½
,, Faggot	,,	21 0 0	,,	21 10 0	,,
TIN:					
English, Block	p.cwt.	6 12 0	,,	0 0 0	3½
,, Bar	,,	6 13 0	,,	0 0 0	,,
Foreign, Banca	,,	6 14 0	,,	6 17 0	nett
,, Straits	,,	6 10 0	,,	6 13 0	,,
TINPLATES:					
Charcoal, I.C.	pr.box	1 10 6	,,	1 11 6	3
Coke, I.C.	,,	1 5 0*	,,	1 6 0	,,
LEAD:					
Pig, English	pr.ton	21 10 0	,,	22 0 0	2½
,, Spanish	,,	21 5 0	,,	21 15 0	,,
Sheet	,,	22 10 0	,,	0 0 0	,,
SPELTER:					
On the spot	,,	20 17 6	,,	21 0 0	nett
For arrival	,,	20 17 6	,,	21 0 0	,,
ZINC:					
English Sheet	,,	27 0 0	,,	0 0 0	1½
QUICKSILVER	pr.btl.	7 0 0	,,	0 0 0	1½

REMARKS.—Business in metals continues to be on a very limited scale, and as a consequence the price of all tends downward, yet without any important change to note.

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 18, 1859.

EDUCATED FEMALE LABOUR.

IT is far easier to sneer at the "rights of "woman" than to show why the wrongs of woman should not be redressed. We Englishmen, to whom "home" is the sweetest and most precious possession, are too much in the habit of seeing in woman only the raw material for conversion into wives and mothers. We think of women as the attendants and helpers of men, and nothing more. Or if more, then only when

> "Man is the hunter; woman is his game;
> "The sleek and shining creatures of the chase,
> "We hunt them for the beauty of their skins."

But in all this we men are wrong—stupidly, blindly, heartlessly wrong. Doubtless the great and primary office of woman is that of being man's "help-meet." But as doubtless this is not, cannot be, her only calling. To many a woman the hope of marriage never comes; to many more the dream of wedded life dissolves before its realisation is attained; to others, scarcely have the bridal bells ceased clashing ere the husband is tolled to his tomb; others put on with the weeds of widowhood the burden of providing for a numerous family; and so forth. On all sides we are surrounded by women whom God and Nature have cut off from man's immediate aid, and who by brain or hand must win, for themselves at least, their daily bread.

It would be rather late for us now to attempt to show how few are the means by which women thus circumstanced can at present obtain livelihoods. It is well known the one chief calling which is open to them—that of a governess—has gradually been so brought down that we have come to consider it but little, if any, superior to that of the humblest menial service; and it is equally well known that scarcely any other outlet for female activity has hitherto been deemed respectable. These facts have lately been much considered by the public, and many measures have been taken for bringing about a better state of things. The latest movements are, first, the establishment of "registers of woman's work," to be managed by committees of ladies, and in which may be registered the names of any ladies who wish to become candidates for remunerative employment in charitable institutions, as nurses in hospitals, matrons in workhouses, teachers or superintendents in industrial schools—likewise for those who desire to obtain situations as secretaries, clerks, or bookkeepers, while other kinds of employment will in all probability gradually suggest themselves in accordance with the needs of society; and, secondly, the establishment of a society for promoting the employment of women. The committee includes several ladies of title; Viscount Raynham, M.P., is the treasurer. A statement has been published in which various objections to the employment of women are answered. It appears also from this statement that it is the intention of the society to establish a large school for girls and young women, where they may be specially trained to wait in shops, by being thoroughly well instructed in accounts, bookkeeping, &c.; be taught to fold and tie up parcels, and perform many other little acts which a retired shopwoman could teach them. The necessity of politeness towards customers, and a constant self-command, will also be duly impressed upon them. Girls educated in this school would be capable of becoming clerks, cashiers, and ticket-sellers at railway stations. It is also contemplated to establish workshops in connexion with the school, where the girls might be taught other trades—trades well suited to women, but now almost exclusively in the hands of men, such as printing and hairdressing, for instance. As the means of the society increased so would the number of workshops and the variety of trades taught. No girl would be admitted to either school or workshop who did not bear a good character; nor, on leaving, would she be recommended for employment till she had passed such examinations as proved her to be competent for it.

This is all most gratifying; and in pursuance of the good work we would urge upon the promoters of these movements the immense importance of multiplying lady mechanics! We want all our men for our heavier trades, such as engineers, builders, shipwrights, blacksmiths, and so forth—trades to which we can never put woman; and we may very well hand over our lighter mechanical crafts to our poorer females. It is, of course, simply disgraceful to see the young women of our land forced by thousands into vicious courses for mere want of employment, while equal numbers of our young men are draining away their manly qualities behind drapers' counters, in hairdressers' rooms, and in scores of other occupations for which women would display equal, if not greater, aptitude; and although light mechanical trades are less obnoxious to man's manliness than such occupations as those just mentioned, they may doubtless be entrusted to women with advantage to both sexes.

There is one trade in particular for which woman is eminently adapted, which should not be lost sight of in this discussion, viz., that of the watchmaker. Mr. John Bennett, of Cheapside, has very nobly advocated the introduction of female labour into the watch-manufacture, at the expense of much personal odium; and so effectually has he stated his case, that some of those watchmakers who denounced his labours in this matter, are prudently bringing up their own daughters to the business. Mr. Bennett tells us, not only that women are in all respects competent to make watches, but that we British people are absolutely importing large numbers of women-made watches every year.

The Paris Exhibition must, he says, have opened the eyes of all but the wilfully blind to the startling fact, that quality, strength, and elegance considered, the Swiss are nearly 40 per cent. under our prices. "So striking was their "superiority, except in our first-class watch," he remarks, "that I took my own eyes for a "month through their principal manufacturing "districts. There I found causes in active "operation that explain the whole matter. "From three leading manufacturers I learnt "that 1,500,000 were made last year in the "Neufchatel district, and this over and above "the produce of the Geneva district. They "declare, too, that their powers of production "have doubled in the last seven years. The "marvellous ingenuity of their tools and their "skilful economy of labour fully confirm this "statement." So prosperous has been the handicraft of these intelligent mountaineers, that thousands of men and women engaged in the trade people all the hills and valleys far and wide, from the Val de St. Imier, in Berne, in the North, down below St. Croix, looking over the Lake of Geneva. Compare the thousands there, from north to south, with our manufacturers. Within the London district, including every dealer who professes and calls himself a watchmaker, we had in 1851 but 4,800 in the trade. And what is the result? That we have become customers to these very Swiss for watches for our own use at home. Thousands of women are at this moment finding profitable employment at the most delicate portions of watchwork throughout the district round Neufchatel. The subdivision of labour is there wisely made so minute as to adjust itself precisely to the special capabilities of every woman's individual dexterity. It is impossible to believe that the women of London will do badly what the Swiss women are now doing so well. Thousands of the women of London, now in dire distress, have the power to equal and perhaps to outstrip their Swiss sisters in a rival race for an honourable and abundant means of subsistence. "I know the realization of my sugges- "tions to be within their reach, and I be- "lieve," says Mr. Bennett, "there are few men "of any worth who will refuse to join me in "the wish that Heaven may grant that this "desirable means of rescuing so many from "their present misery may be speedily re- "moved from the necessity of newspaper dis- "cussion."

We agree with Mr. Bennett; and if Viscount Raynham and his colleagues would do their work effectually, they should inquire closely into this watchmaking question, which lies ready to their hand. In their whole movement we wish them the most perfect success.

THE MEASUREMENT OF WAVES.

THE name of the late Dr. Scoresby has been associated more prominently than that of any other man with the subject of wave-measurement. His estimates of the heights and breadths of Atlantic waves have entered into many important discussions of late years, and have formed the basis of serious arguments respecting the dimensions of large ships and other great questions. The interest attached to his observations on this subject does not appear to have arisen from any extraordinary aptitude on his part, or from the possession by him of any special apparatuses for the purpose. Any other intelligent person accustomed to estimating heights and distances by the eye, or by the aid of simple mechanical expedients, could have done all that Dr. Scoresby ever did, or ever pretended to do, in the way of obtaining data respecting the dimensions of waves. But, strange to say, of all the thousands of clever mechanical men who sail the seas in pursuance of their various avocations, only here and there one is found to bestow a little attention to this very interesting topic. With this fact before us we cannot but be grateful for the pains which Dr. Scoresby repeatedly took to enlighten us, and especially for the ample information which he has afforded us in his journal of his voyage round the world in the Royal Charter, to which we drew attention in our last number.

It may be of some interest to describe the methods adopted by him on that occasion for obtaining scales of measurement for the height, distance of the undulations, and velocity of the waves. They were, in the main, similar to those which he adopted in his inquiries on the waves of the Atlantic, the results of which were communicated to the British Association at its meeting in Edinburgh, in 1850. In writing of the great gale which overtook the ship on her voyage to Australia in April, 1856, he says: "As "the ship was scudding directly before the gale, "and was astonishingly steady and upright for "considerable intervals of time; and as, not- "withstanding her great length, she found an "ample extent for being evenly cradled, as to "her general bearings of flotation betwixt wave "and wave, it was easy to find a scale, as I did, "by ascending the mizen rigging, by which the

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"height of the ordinary and highest waves, as "they might be found to correspond with or to "intercept the sea horizon, could be satisfac- "torily measured." In this way, ascending by steps, after a first position taken at a guess, he found that with his feet on the seventh rattling he had the line of elevation of the prevalent wall-formed waves. But he attained the interval between the sixteenth and seventeenth rattling before he obtained the measure of elevation of the waves of the maximum class. Of these, several rose still higher, but he kept his position till one or more of great breadth and solidity of mass was seen rising above the horizon along an unbroken extent of some hundreds of feet. The height of the eye of a man of Dr. Scoresby's stature in this position above the eye of a similar person on the saloon deck below was 15½ ft., and the height of view on the deck, as otherwise estimated, was about 23 feet; the sum of 38½ feet was therefore obtained for the maximum class of the prevailing waves. But, as the wave specially noted was more than two feet higher than the horizontal level, its actual height could not have been less than 41 or 42 feet. But from the station of observation several incidental peaks or points of waves, often thrown up by the intersections of cross seas, were observed to exceed considerably the ordinary maximum, whilst the *tops* of breaking crests might be seen rising still higher, indicating an ultimate maximum which could hardly be less, the Doctor thinks, than 50 feet.

The next points of inquiry were the distance of the waves from crest to crest, and their general velocity. These measurements, however, from the want of regularity in the sea—a peculiarity of the waves of the Southern Ocean—could not be so conclusively determined as the height; but proximately, the results were very satisfactory as compared with similar investigations in the North Atlantic. The time occupied by the waves in successively passing the ship was found when the ship's rate of going was *about* 12 knots to be generally (in the case of distinct series of heavy rollers) about 18 seconds. With this fact for his guidance, Dr. Scoresby ascended the main rigging to a convenient height, where, being over the centre of the ship, he could observe when the crest of a wave went beneath the stern and when it emerged from beneath the bow. This observation frequently repeated gave him a pretty regular result (as shown by the counting of seconds with a watch at his ear) of nine seconds for the interval occupied in the passage of the ship's length, say 320 feet, and of nine seconds more for the arrival at the stern of the following wave.* This indicated plainly a distance of just about twice the ship's length, or 640 feet for the prevalent space, transversely to their axes, from crest to crest of the waves.

A tolerably correct estimate of the velocity of waves became fairly deducible from these data. A space was seen to be passed over by any particular wave, with reference to the ship's position, of about 640 feet in 18 seconds; but this was of course too small by the proportion of the ship's retreat from the wave, or her advance in the same direction during the same interval. Taking the geographical mile at 6,075 feet, we find the quantity of 1·69 feet per knot to be due to each second of time; or 20·28 feet per second as the ship's progress when going 12 knots. This multiplied by 9, the number of seconds occupied by the sea in running the length of the ship, gives a product of 182·52 feet for the advance of the ship in the same line and within the same interval. To the velocity of the waves, therefore, reckoned on the ground of the ship being stationary—say 320 feet in nine seconds, or 35·56 feet per second—we add the advance of the ship, or 20·28 feet per second, in the same line of direction, and thus obtain for the actual velocity of the wave 55·84 feet per second, or 33·9 geographical miles per hour—a result the more satisfactory seeing that in making a like experiment on very high waves (30 feet) measured in the North Atlantic, in 1847, Dr. Scoresby obtained for these waves a distance from crest to crest of 559 feet, and a velocity of 32·67 miles per hour.

* The length of the Royal Charter's keel was 308½ feet; length over all 336 feet. But he estimated, as he believed, a medium of the rake and overhang, and therefore took about a mean measure or estimate of 320 feet for the ship's length.

THE EXHIBITION OF 1862.

SIR THOMAS PHILLIPS, the Chairman of the Council of the Society of Arts, in his opening address, delivered on Wednesday evening last, announced the intentions of the Council in reference to the Exhibition of 1862. Before repeating the statements made by him, it may be well to go with Sir Thomas over the preliminary facts of this matter.

The subject of international exhibitions of works of industry and art having been brought under the notice of the Council of the Society in the session of 1858, received their careful consideration, and occupied much of their time in that as well as in the following session, and in the address of Sir Thomas Phillips's predecessor at the beginning of last session, and in the report of the Council presented at its close, a narrative of the proceedings of the Council in relation to the subject was presented to the members of the Society. The Council having bestowed on this question that grave attention which the importance of the subject deserves, resolved, on the 14th of April, 1858, that the Institution of Decennial Exhibitions in London, for the purpose of showing the progress made in industry and art during each period of 10 years, would tend greatly to the encouragement of arts, manufactures, and commerce, and that the first of these exhibitions, which it was then intended to hold in 1861, should consist of works selected for excellence, illustrating especially the progress of industry and art, arranged according to classes, and not countries, and should comprise music and painting. The investigations of the Council led them to conclude that an international exhibition in 1861 would elicit even more valuable results than had been achieved in 1851.

While the Council was actually preparing to originate the exhibition, hostile gatherings, of which Italy was the centre and object, threatened to involve the principal continental States in active and protracted warfare. The probable influences on an international exhibition of the unexpected interruption to the peaceful relations of the States of Western Europe led the Council, in the month of May last, to determine that the international exhibition proposed to be held in 1861 should be postponed to a more favourable opportunity. That decision was arrived at by the Council with much regret. "An exhibition," said Sir Thomas, "which should present an adequate picture "of the progress of arts and industry, when "employed in extending the blessings of peace "and promoting the progress of civilisation, "might prove of special utility at a season of "strife and warfare; and even if war were "again to interrupt the peaceful intercourse of "continental States, it is obviously within the "power of the United Kingdom, including the "colonies and dependencies of the empire, to "produce an exhibition deserving of national "patronage. The progress of art and industry "is not suspended, however much it may be "interrupted by actual warfare, and the loom "and the forge may pursue their wonted acti- "vity even amid the din of arms." The past history and present position of our country alike impose on Englishmen, continued Sir Thomas, duties which cannot be evaded with dignity, and they surely may decide themselves whether and when they will hold exhibitions of art and industry, although warlike preparations may seem to occupy other nations. The war in Italy having terminated, the Council have anxiously resumed the consideration of this important subject, and, notwithstanding the present aspect of continental affairs, which they do not regard as the most favourable to arts, manufactures, or commerce, it is nevertheless the intention of the Council, interpreting aright, as they believe, the feelings of their countrymen, to originate measures for carrying into effect an international exhibition of works of art and industry, to be held in 1862; and they propose to invite the manufacturers, merchants, public companies, and other capitalists willing to promote such an exhibition, to unite in raising a guarantee fund, not less in amount than £250,000, to be vested in trustees whose position, character, and qualifications will secure the confidence of those capitalists who are prepared to share the responsibility of the undertaking. It is the intention of the Council that full and absolute power to originate and conduct the exhibition shall be vested in such trustees, and that the permanent buildings which may be found necessary shall vest in the Society of Arts, in order that such buildings may be devoted to future exhibitions, and when not so occupied may be employed for purposes tending to the promotion of arts, manufactures, and commerce. The trustees will doubtless seek the assistance of Her Majesty's Government in order the better to obtain the friendly assistance of foreign Governments and secure the co-operation of foreign exhibitors, and otherwise promote the success of the exhibition of 1862, and will also apply to the Royal Commissioners for the Exhibition of 1851 to grant a convenient portion of the ground purchased at Kensington out of the surplus funds of the Exhibition of 1851 for the next and future exhibitions.

THE DRAINAGE OF LONDON.

IN November last, we drew attention to an interesting publication by Mr. Charles Glassford, of Greenwich, entitled "London Sewage, shall it "be Wasted, or Economised? Being a Plan "for the Collection and Treatment of the Foecal "Matter of Towns, for Purifying the Sewers and "Rivers, and Removing the Chief Impurities, "which render them Dangerous to the Health "of Communities, with especial and immediate "reference to the Metropolis, the River Thames, "and the Board of Works' Main Drainage "Scheme." Since that period, several modifications of Mr. Glassford's plan have been suggested, which considerably affect the results. Before entering upon these, it may be advisable to recapitulate very briefly the chief points of the plan, as detailed in the above publication. Mr. Glassford proposed, first, to collect the excrementitious matter directly from the water-closet, with such a limited and measured quantity of water as should make the subsequent operations for the recovery of the fertilising matter economically practicable. Second, to convey the excreta and water through a system of pipes and sunk vessels to large reservoirs at a distance from town, where it is to be deodorised, and neutralized with oil of vitriol; then allowed to subside for a few hours. The effect of this treatment will be, that the whole of the nitro-

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genous matter of the urine—the most valuable constituent—is saved, and fixed in the form of sulphate of ammonia. Third, the liquid portion is pumped into a system of boilers and evaporating vessels, where it is concentrated into a crystalline mass, which is chiefly sulphate of ammonia, with all the other valuable salts contained in the urine, the agricultural value of which Mr. Glassford proposes now to reckon at £10 per ton. The more solid portion collected by subsidence in the reservoirs is pumped up separately, and conveyed into a series of presses, or filtering machines, which separate the solid and insoluble portions from the liquid, and finally present it in an almost dry, solid, and inodorous cake, containing the organic matter and insoluble phosphates of the solid excreta, the agricultural value of which he reckons at £4 per ton.

These values are obtained by estimation of the market prices of the constituents, in the way usually resorted to by agricultural chemists in their estimation of guano and other manures. Mr. Glassford has estimated that the yield of these manurial products from the London excreta would amount to 136¼ tons daily, from the liquid part; whilst that from the solid part would amount to seventy tons daily. In his estimate for London, he assumed £15 per ton as the value of the urine salts, but as this has been objected to as too high, he has decided now to assume £10 per ton nett price, after paying charges of delivery, agency, discount, &c. The other manure is not, he considers, too high at £4 per ton nett, after paying these charges. The result at these prices would thus be :—

	Per annum.
For 136¼ tons urine sulph. of ammonia per day, at £10 per ton	£497,312
„ 70 tons solid organic manure, per day, at £4	102,200
	£599,512

or as nearly as possible six hundred thousand pounds per annum, after paying all agency, carriage, and discount charges. "I have esti-"mated the annual costs of materials, such as "coals and vitriol, and of labour, at nearly "£237,000, and of interest on cost of necessary "works, tear and wear, &c., at £170,000, which "sums together amount to £407,000 of total ex-"penses of all kinds, and, allowing very liber-"ally for every possible charge, leaves a sum of "nearly £200,000 annual profit; a sum which "would be found of enormous advantage in "carrying out the improvements—useful and "ornamental—so urgently required in this our "crowded metropolis."

It has been objected to the plan that Mr. Glassford proposes to use a water-closet apparatus which is too complicated, which would be likely to get out of order, and that the quantity of water proposed by him is too little. To these objections he now replies :—First, that the ordinary earthenware pan and syphon trap, so extensively and universally used, would answer all the purposes required, so that there need be no alteration whatever in that part of the present closet arrangements; the only alteration required would be the substitution of a regulator valve instead of the usual stopcock, or other water supply arrangement. This would avoid great expense, and would be equally if not more efficient than that previously proposed. Second, instead of limiting the supply of water to the closet pan to twelve ounces per discharge, he would now allow any quantity up to one gallon per delivery per individual—a quantity which he considers far beyond what would, under any circumstances, be required; but in this case—as the quantity of water to be removed, collected, and evaporated, is greatly increased, the cost of apparatus, fuel, and labour would also be increased, whilst the material products would remain the same—the profits per annum would be diminished. "For each addition of twelve "ounces of water thus employed in the closet, "there would be an addition of about "£10,000 to the cost of apparatus (works), "and a reduction of about £3,150 from "the profits, so that the employment of "one gallon of water per individual (or per "delivery in closet) would have the effect only "of reducing the annual revenue by about "£35,000." As to the objections which may be made in reference to the mechanical difficulties of the scheme, Mr. Glassford apprehends no difficulty that he would himself (although not a civil engineer) feel unwilling to undertake. In this country especially, as he says, we should be under no fear of easily overcoming any difficulties of a mechanical kind.

As the best method of determining the worth of any scheme is to put it in practice, Mr. Glassford earnestly urges the advisability of making a trial on, say, 500 to 1,000 dwelling-houses, grouped together in the same locality, so that all the products could be economically conveyed and collected together at a short distance, and there operated on; and we would gladly support him in this request. The operations can be conducted upon any quantity and upon any scale, so as to yield results which would amply test the value of the scheme, and enable a clear and practical judgment to be formed. To do all this, from one to two thousand pounds would be amply sufficient, and in a few weeks from the commencement the experiment would be in full work and yielding results. "I would "be glad to assist with my services," says Mr. Glassford, "in carrying out the plan and bring-"ing it to an issue."

"If we consider for a moment," says Mr. Glassford finally, "the vast sums of money "which will unavoidably be absorbed in exe-"cuting the very gigantic sewage works now in "course of formation throughout London, which "may absorb more millions than is now con-"templated, besides the large annual sum "required to keep the whole in good working "order—if we consider, also, the number of "years which must elapse before these "works are completed—and if we consider, "also, that fertilising matter (worth to our "agriculturists a million sterling per annum), "according to all our highest scientific autho-"rities, including Liebig, Hofmann, and others, "is still, after all this great expense and years "of delay, only to be thrown away into the "Thames, a few miles lower down the stream, "without the certainty of relief from the nui-"sance or the shadow of a possibility of any "return being ever obtained for all the outlay "and annoyance, we shall have a clearer per-"ception of the enormity of this Main Drainage "Scheme."

We need hardly add that these views are our own. Mr. Glassford's proposals are consistent with good sense and the soundest science, and if our Metropolitan officials are not wholly blind they will lose no time in testing them, at least upon a small scale.

THE STOKE-HOLES OF STEAM-SHIPS.

No class of men suffer more from an overheated atmosphere than stokers, especially when they are employed in steam-vessels, and yet there is none to whom relief can be more readily and advantageously given. The stoke-holes of all steam-vessels may be kept at within 5° of the outer atmosphere at an almost nominal expense, and the means of doing this are attended by other advantages.

If our readers will consult a paper read before the Institution of Civil Engineers on the 14th November, 1854, No. 917, by Mr. William Woodcock, they will find the subject is there fully explained. The *modus operandi* is simply as follows :—Place immediately underneath the fire-bars two Venetian blinds, made of hoop iron, the bars lying horizontally and parallel to each other in the direction of their length, and inclined at an angle of 45° to the horizon in the direction of their width. The bars of the two sets must be inclined in opposite directions, and must be so close together that a vertical straight line cannot pass between any adjacent pair of them, and yet far enough apart to allow all cinders to fall freely through them. This device will keep the air in the ash-pit cool. Next, fasten upon the inner face of the fire-door a box made of angle iron, and projecting about an inch and a half into the furnace when the door is closed. Let this box be fitted with a few thicknesses of wire gauze, Nos. 8, 10, and 12, lying close together against its fire front, and leaving a space of at least one inch opening in the box between the gauze and the inner front of the door. Further, let all that part of the door which is within the box be drilled as full as possible of ½-inch holes, and it will be found that the door will by these means at all times be kept cool. The merits of this invention belong to Mr. Burney, of Battersea. We have now only the bulk-head of the boiler and the smoke-box doors to deal with. In front of these, and at one inch distance from them, secure, so as to open and close with the doors, a plate of iron or zinc; the latter will be better, as this plate must not be painted. Let the upper part of the one inch opening communicate directly by a pipe or otherwise with the deck. No heat will then escape into the stoke-hole from the boiler or from the smoke-box, and an upcast will be established over their front which will draw a supply of fresh air into the stoke-hole from any convenient source, whether the vessel is in motion or at rest, and the third and last source of heat in the stoke-hole will thus be cut off. This is all that has to be done. It involves the infringement of no patent-right, and can be arranged for a very trifling expense by any intelligent engineer.

Much has been written upon the combustion of smoke, and the respective merits of hot and cold air. The truth may be, that both are required. The above arrangement, if properly carried out, will be the most perfect smoke consumer, or rather smoke preventer, known. It will also save some small per-centage of fuel. Cold air is required to enter through the bars in order to give direct to the fuel the largest amount of oxygen in the smallest space; this the keeping of the ash-pit cool provides for. Upon this all are agreed. Warm air must also, many believe, be administered to the gases distilled from the coal, as otherwise they may be reduced below their "flame points" of heat; this is done by the respirator in the door, from the fact of the air passing through it having to impinge upon the heated wire gauze. No valve or regulator is wanted, as the fine wire gauze is found to check the supply when but little air is wanted, and to admit a large quantity when that is required, *i.e.*, directly after firing, and when the bars are covered with fuel.

We claim no novelty for these suggestions, the credit of which is mainly due to Mr. Woodcock, the managing engineer of the London Warming and Ventilating Company. We simply confine ourselves to recommending them to the notice of those engineers and owners of vessels, many of whom are unhappily content to keep their stokers at work in temperatures which no human constitutions can long withstand.

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Literature.

Journal of a Voyage to Australia and round the World for Magnetical Research. By the Rev. W. SCORESBY, D.D., F.R.S., etc. Edited by ARCHIBALD SMITH, Esq., M.A., F.R.S., &c. London: Longman, Green, Longman, and Roberts. 1859.

[SECOND NOTICE.]

IN our last number we promised some extracts of interest from this work. The first shall be upon

THE FORM OF THE ROYAL CHARTER.

"In regard to pitching and 'sending,' the action of the ship was equally remarkable, both for the easiness of the motion and the smallness of the inclination of the keel from the horizontal level. A forty feet wave, on its entrance below the stern or counter of the ship, whilst the bow was exactly in the lowest or most depressed portion betwixt crest and crest, should raise the stern, as from the simplest view of the case it might seem, to at least its own elevation, or give an angle of inclination to the keel of about 7°; but no such measure of pitching or 'sending' motion was ever observed—probably not above half as much. For in no instance, in scudding, did I ever observe the bow of the ship plunge nor the stern rise to anything like the position apparently due to the elevation of the passing waves. The action, indeed, was obviously of this nature: from the admirable adjustment of the ship's *lines* of construction forward and aft, the loftiest wave on its reaching the stern-post below exerts its lifting tendency, not abruptly or suddenly, as where the *quarters* are heavy and the run thick, but very gradually, so that the disturbing force, passing beyond the place of greatest influence before its due action is realised, becomes modified and reduced. These principles are no doubt in operation in every tolerable model of marine architecture, but not to the degree of perfection in which the tendency to assume horizontality of position, and to receive the least possible disturbing effects from the most formidable disturbing causes in the action of rough, irregular, or heavy seas, has been attained in the modelling and building of the Royal Charter; and whilst similar results in kind will be found to have been obtained in very many or most of the scientifically constructed and splendid clipper and other first-class ships of this important age, I should much doubt whether in any single instance the approach to perfectness of the model of the Royal Charter has been exceeded, or even, in all the elements of the perfect 'sea-boat,' as adapted for these southern regions, proverbial turbulent seas and boisterous weather, been equalled." (Pages 125-6-7.)

The next extract shall consist of certain suggestions by Dr. Scoresby upon

THE IMPROVEMENT OF THE ADMIRALTY STANDARD COMPASS.

"Two improvements in the Admiralty standard compass, for its better adaptation to delicate observations or deviations, and for determining the true magnetic bearings of distant objects, were suggested by these and other observations made at Port Philip. The first was the adaptation of a much lighter card for being used under circumstances of great stillness and weak horizontal directive force. Before I was aware of the defective traversing of the lightest of the two cards usually supplied, though placed on one of the finest points, I was annoyed by finding differences in observations repeated, and in all respects similar or analogous, sometimes amounting to 1½° or 2°, and in two or three instances of still more. Such differences, indeed, I might have been prepared to expect in a new ship recently launched, and when being swung in different directions, especially under the vibration from hawsers employed in heaving round; but in our case there were no such influences in operation. On tapping the compass-bowl with the butt-end of a lead pencil, the discrepancies were sufficiently explained by observing frequently an immediate change in the direction of the card. This precaution, therefore, was subsequently adopted on each observation. Another improvement, as it occurred to me, in a fine instrument designed to be employed as a steering, azimuth, or 'swinging' compass, would be the adaptation of a small telescope, adjusted to the circularly-moving rim, for giving assistance in observations of objects or positions on shore, when, as in the case of our reciprocal bearing, the place of the shore instruments could not be seen through the sights. Such telescope, too, would be of the greatest use when, as I repeatedly found, the shore object (its point, bluff, or other recognizable place) could only be indistinctly seen. In many cases whilst pursuing my observations in Hobson's Bay, the Saddle on the Dandelon, or the termination of the Red Bluff, could not be seen without the help of a glass (I usually employed an opera-glass), leaving the bearing by the sights to be made out by various shifts, such as the incidental proximity of some more visible point or object—a boat passing, a rope on board the ship, &c., for getting the bearing required. An attached telescope would have relieved me from all these embarrassments and risks of inaccuracy. It might possibly be applied to one or other of the shifting rims at present adopted; but in any convenient form it would be a valuable addition to the instrument." (Pages 179-80.)

The next quotation may consist of the following remarks on the fouling of the Royal Charter's bottom, and Dr. Scoresby's proposal for remedying the evil:—

THE FOULING AND CLEANSING OF IRON SHIPS' BOTTOMS.

"Though the ship had made capital progress for the fluctuating strength of the wind, we could not but remark that her sailing in light and moderate breezes was, for a ship of her build, rather heavy. This was ascribed to a disadvantage not hitherto overcome in iron ships—the rapid and extensive fouling of their bottoms by the adhesion and growth of weeds, barnacles, &c., which necessarily produce a deteriorating effect on a ship's sailing qualities. Various contrivances in paint and chemical colouring have been resorted to for the overcoming of this evil, but hitherto without much success. Nor has any process yet been devised for the clearing away of the fouling attachments without the costly and often impracticable operation of docking the ship. It has occurred to me, however, that much of the disadvantage might be overcome by a process of scraping, with no very complex arrangements for the guidance of the apparatus by means of a framework of changeable curvature guided by the keel; and an essential element in such arrangement, it seems to me, would be the attachment to the scraping apparatus designed for the bottom of the ship of buoyant or water tight air vessels, by which any degree of upward pressure on the scraper might be given. To the details of such an apparatus—which might be moved by rope forward and aft, as well as at right angles with the longitudinal motion by similar means—my attention has not been directed, nor might my habits of contrivance at all compete with the ingenuity and invention of practical and ingenious engineers or artizans." (Page 262.)

Our last extracts shall be on

MR. SMALL'S INSTRUMENT FOR DETERMINING COMPASS ERRORS.

"Among the magnetical and compass observations made in the course of the day, I made farther trial (having before had the instrument in action) of an ingenious patented invention of Mr. Andrew Small, maker and adjuster of compasses, of Glasgow, for finding by direct observation the true meridian, and consequently "the errors in deviation and variation of the mariner's compass." The instrument consists of an attachment to a compass on the ordinary principle of certain moveable circles in brass—a true meridian circle, an hour circle, and an equatorial circle, on the adjustment of which, in reference to the latitude, declination of the sun and apparent time, proximately, a stream of light from the sun's rays passing through a slit in the moveable hour circle is made, by the swinging of the interior framework of the apparatus, to fall on the middle of the interior of the opposite side of the same circle (or to be put into position by using the slit as sight vanes), by which the meridianal circle takes the position of the true north and south. The difference betwixt this and the direction of the compass-needle gives, of course, the errors of the compass observed with, in whatever position it may happen to be placed, and by comparison with the steering or other compass determines also its errors. My object being simply to test by experiment the performance of the instrument, to this object I confined myself, by a series of trials carried on from about 2 to 3 p.m., and frequently repeated. The deviation of which combined with the variation I had ascertained to be 7° westerly, and appeared to agree very well." (Pages 266-7.) "Repeated trials of the ingenious contrivance of Mr. A. Small, Glasgow, for determining by inspection the direction of the true meridian, and from thence the compass errors in deviation and variation, enabled me at length to form a decided estimate of its capabilities. The result was, that for moderate horary angles from noon the instrument acted well, pointing out the true meridian generally to within a degree or two, where the latitude and apparent time were pretty well known; but in the case of considerable intervals from noon, extending, as in our circumstances, to upwards of three hours from noon, the results become obviously erroneous to the extent, as at 7.30 a.m., of about 10 or 12 degrees to the westward of the truth, and at 5 p.m. to nearly as much to the eastward. This tendency to error in large hour angles I had suspected at an early period of my acquaintance with the instrument, on account of the results being obtained in dependence of a plane only proximately coinciding with the plane or cone of the sun's motion in the heavens. For observations, however, within moderate limits, the instrument appeared to work well, and readily gave the required information." (Pages 273-4.)

LIST OF NEW BOOKS.

Godfrey's Treatise on the Lunar Theory, 2nd edit., 5s. 6d.
O'Bryne's Naval Manual, 1860, 1s.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

November 8th, 1859. Joseph Locke, Esq., M.P., President, in the chair.

The paper read was "ON THE PROCESS OF RAISING AND ON HANGING THE BELLS, IN THE CLOCK TOWER, at the New Palace, Westminster," by Mr. Jabez James, Assoc. Inst. C.E.

It was stated that the first large bell, which weighed upwards of 15 tons 18 cwt., and was cast by Messrs. Warner and Co., at Norton, near Stockton-on-Tees, was fractured while suspended from a staging at the base of the tower, during the course of experiments on the tone of the bell. The fracture took place on the opposite side from where the bell was struck by the clapper, which weighed 12 cwt. It passed from the lip through the sound-bow, and extended up the waist of the bell, and was about 40 inches in length from the lip. The fracture seemed to be clean, and the metal had a coarse dull appearance, and was full of minute holes, which were noticed in other parts of the bell when it was afterwards broken up. The four quarter bells were also cast by Messrs. Warner, but the third having been condemned as defective, had to be recast. The first, weighing rather more than 1 ton 1 cwt., was lifted in three hours; the second, weighing upwards of 1 ton 5 cwt., occupied three hours and a half; the third, which weighed above 1 ton 13¼ cwt., took four hours. These three bells were raised by means of a single chain, made of bars 7-8ths of an inch diameter, and a crab with a double purchase. The fourth quarter bell, weighing more than 3 tons 17½ cwt.., was lifted in six hours by a similar chain, reeved through a single pulley, and by a double purchase-crab. These bells were hung at the four angles of the tower, around the large

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bell, for the convenience of sounding, &c. The second large bell weighed upwards of 13½ tons, and was cast by Messrs. Mears, at Whitechapel. The best method for raising this bell in a safe and economical manner having been carefully considered, it was decided to use a treble-purchase crab, with large blocks and a fall. A new chain, made by Messrs. Hawks, Crawshay, & Co., 1,500 feet in length, and tested to a strain of 10 tons, was employed. This chain, when reeved through two three-sheave blocks, and with a standing chain, gave a power equal to about 70 tons. As the bell was 9 feet in diameter at the sound bow, and 7 feet 10½ inches in height, and the dimensions of the tower were only 8 feet 6 inches by 11 feet 1 inch, it was not possible to lift it by the crown, with the mouth downwards. Consequently, a cradle had to be constructed in which the bell should rest on its side. Friction rollers were attached to the cradle at the top and at the bottom, which served as guides, and rubbed against balks of timber set upright in the shaft. The upper block was made fast, by a shackle and clip, to a flitch beam formed of two plates of iron fixed between six timbers; and the lower block was firmly secured to the cradle by massive bolts and straps. The treble-purchase crab was fixed to a strong staging in the cast-iron lantern at the top of the tower, in such a position as to leave a distance of about 19 feet between the bottom of the crab and the crown of the bell, when the latter was raised to its proper position. As the single barrel of the crab could not take up all the chain without incurring the risk of surging, consequent upon the coiling of the chain in so many thicknesses, several lifts were made, as stated in a tabular statement given in an appendix, in which was also recorded the time occupied for each lift, and the fleeting of the chain. An iron chain-stopper of special construction was made for the purpose of holding the chain during the fleeting on the drum of the crab. The weight of the bell and the cradle and iron work, together with the chain, blocks, &c., was about 25 tons, exclusive of friction. The process of raising commenced at six o'clock in the morning, and continued without intermission, until noon on the following day, when the bell was safely landed on a staging in the clock room. The cradle was then disconnected, and the bell was turned over with the crown upwards. An eye-bolt was passed through, and being now clear of the shaft, the bell was lifted in the usual way from the clock room to the bell chamber. The total height the bell was raised was 201 feet 3½ inches, at an average velocity of about 6 feet 5 inches per hour. The paper then proceeded to state the experiments that had been made before the weight of the hammer and the distance it should fall through were finally settled. The weight was decided to be 6 cwt. 3 qrs. 10 lbs., with a fall of 13 inches. This arrangement for striking the hours was continued until the bell was discovered to be fractured in two places. One of the cracks was precisely in the same position in this bell as in the former one, exactly opposite to the place where it was struck by the hammer, and the other was about two feet away from it. The first fracture appeared to be about 15 inches and the second about 24 inches long; but they did not extend through the thickness of the metal, nor within 2 or 3 inches of the lip at present. The whole of the works for raising the bell were carried out by Mr. Hart, assistant to Mr. James, under the superintendence of Mr. Quarm, Clerk of the Works at the New Palace.

In the discussion, it was remarked, that the composition of the metal of the bell was not the same as that usually adopted in this country and on the Continent, there being a greater proportion of tin than was customary. It was also thought that the use of charcoal-smelted copper, as was the case in Russia, was advantageous. It was suggested whether the interval between the blows of the hammer might not have been too short, and whether the chattering of the hammer, due to its not being cleared immediately after striking, might not have a tendency to produce numbness, and hence stun the bell and contribute to its fracture. It was urged that the great weight and fall given to the hammer must have acted prejudicially. These were supposed to be rendered necessary by the thickness of the metal, which had been made considerable, in order to guard against accident; but it was contended that it had a contrary tendency.

ROYAL GEOGRAPHICAL SOCIETY.

ON Monday night, at one of the largest meetings, perhaps, ever held of the Royal Geographical Society, Captain M'Clintock, the distinguished Arctic navigator, read a memoir of his voyage on board the Fox in search of the survivors of the expedition of Sir John Franklin. The meeting, convened at half-past 8 o'clock, and at which Sir Roderick Murchison presided, was held in Burlington-house, Piccadilly.

Captain M'Clintock, who was cheered on presenting himself to the meeting, read his memoir of the incidents and results of his voyage, which, in point of fact, embodied the more interesting portions of his dispatches to the Admiralty published the day after his return to this country, and which are still so fresh in the public recollection as to render a repetition of them unnecessary. At its conclusion, however, he said there were two important questions which had been so frequently asked him that he gladly availed himself of that opportunity of offering some explanation upon so deeply interesting a subject. The first question was, whether some of the 105 survivors might not be living among the Esquimaux? The various families or communities of Esquimaux met with by Rae, Anderson, and himself, at different times and places, all agreed in saying, "No, they all died." The western shore of King William Island, along which they were compelled to travel for two-thirds of their route, was uninhabited, and all that was known of the mouth of the Back River was derived from the journeys of Back, Simpson, Anderson, and himself. None of them had met natives there, consequently it was fair to conclude that the Esquimaux but seldom resorted to so inhospitable a locality. In fact, their life was spent in a struggle for existence, and depended mainly upon their skill in taking seals during the long winter—a matter which required such long training that no European had ever yet succeeded in acquiring it. His (Captain M'Clintock's) two Greenland Esquimaux tried various methods at Bellot Strait, yet did not succeed; and without dogs trained to scent out the small breathing holes of the seals through the ice, and through the snow which overlays the ice and conceals them from observation, he did not think that even the Boothian Esquimaux could live. It required not only that a man should possess a trained dog, but that he himself should be so well trained in the only successful mode of seal hunting in this locality in order to subsist. It was therefore evidently an error to suppose that where an Esquimaux could live a civilized man could live there also. Esquimaux habits were so entirely different from those of other people that he believed there was no instance on record of either a white man or an Indian becoming domesticated among them or acquiring tolerable expertness in the management of a kayak. With regard to the probability of procuring the means of subsistence independently of the Esquimaux, he stated what was shot by his own sledge party—and they never lost a chance of shooting anything—during the journey along the lands in question, which occupied them for 79 days and covered nearly 1,000 geographical miles of distance. The sum total amounted to two reindeer, one hare, 17 willow grouse, and three gulls. The second question was, why had the remains of so few of our lost countrymen been found? It was indeed true that only three of the 105 were discovered, but it was to be borne in mind that from the time they left their ships they were dragging sledges and boats, and therefore they must have travelled almost constantly upon the ice—not upon the land—consequently all traces or remains there vanished with the summer thaw of 1848. There was no doubt that many relics still remained strewed along the uninhabited shore of King William Island, beneath the snow; but as it was most carefully examined three times over, he could not think that any conspicuous object, such as would be put up to indicate where records were deposited, could possibly have escaped them. The summer at Port Kennedy proved a warm one, yet the ice did not permit them to move until the 9th of August, and the object of the expedition having been attained, they commenced their homeward voyage.

Sir Roderick Murchison said (among other things), to geographical science the results of Captain M'Clintock's expedition were little less than glorious, for, among others, it had determined for the first time the navigability of Bellot Strait, and the northernmost part of the American continent. In the forthcoming narrative (to be published shortly by Captain M'Clintock) the difficulties which those gallant men had surmounted would be presented to the world in detail. The very first incident of their voyage in a little yacht of only 170 tons was that when they had nearly reached Baffin-bay they were drifted back 1,200 geographical miles into the Atlantic again. But they returned to the charge, and eventually succeeded for the first time in revealing the fate of the illustrious Franklin and his associates. There was no doubt that Franklin went further to the north in a ship than any British seaman—he (Sir R. Murchison) was speaking of the search made in Wellington Channel,—and then he returned, and performed that extraordinary voyage round Cornwallis Island, by which, in the first year of his enterprise, he proved it to be an island.

An interesting discussion followed on the results of Captain M'Clintock's expedition, principally as determining the fate of Franklin, and also as it bore upon the progress of geographical discovery, in which several of the experienced explorers of the Arctic regions present took part, including Sir Edward Belcher, Captain Collinson, Captain Sherard Osborn, Captain Hobson, Captain Snow, and Captain Kennedy. Captain Collinson gave it as his opinion that after Franklin and his comrades abandoned the ships, it was almost impossible, having regard to the question of provisions, and to the probable rate at which they would be able to travel, encumbered as they were with sick, with boats, and facilities for prosecuting their journey, that they could have reached further than the bottom of the estuary of the Great Fish River, and that they all perished. Captain Sherard Osborn, as an Arctic navigator, said he could not resist the conclusion that the search for Franklin was now closed. He had read Captain M'Clintock's journal, which was written from day to day, without any wish to arrive at a particular theory, and therefore on that ground eminently valuable, and he felt that, whatever the track Franklin and his comrades took after abandoning the ships, it was their last journey upon earth, and that they must have perished. Captain Snow in an animated speech stated the reasons for believing it possible that some members of the Franklin expedition still survived, which he has already propounded in the public journals. He submitted that the evidence was not conclusive that they were all lost, and that it would be to the honour of England to make an attempt worthy of her honour to ascertain their fate. He pledged his word, if health were spared to him, and whether he was assisted or not, that he would depart next spring, with the view of going over the whole ground, and, if need were, would ally himself with the Esquimaux until the riddle was solved. Sir R. Murchison, in adjourning the meeting, said it was a great fact in which all those naval officers who had taken part in the discussion, whether belonging to Her Majesty's service or to the mercantile marine, agreed that, although Captain M'Clure was worthily rewarded for making *a* North-West passage, Franklin was the man who made *the* North-West passage.

A vote of thanks having been unanimously accorded to Captain M'Clintock for his memoir, the meeting separated at nearly 11 o'clock.

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THE SOCIETY OF ARTS.

The first ordinary meeting of the 106th session of this society was held on Wednesday evening within their hall, John-street, Adelphi. The attendance was numerous. The chair was taken at 8 o'clock by Sir Thomas Phillips, F.G S.

The Chairman, after numerous applications for admission to the membership of the society, and other routine business had been proceeded with by the secretary, rose, and after alluding to the time-honoured custom of the society, that the session should be opened by an address from the chairman of the council, acquainting members with the policy which the council designed to follow during the ensuing session, proceeded to notice the decease of several members, the election of Sir William Page Wood to a vice-presidentship left vacant by the death of Robert Stephenson, and the Exhibition of 1862. The progress of art and the organisation of local boards were next referred to in the address. It was also intimated that the Turner and Vernon collections of paintings at South Kensington would shortly be opened to the public during the evening. The present state of the law of copyright was next referred to, as well as another important matter which had been brought before the society under the presidency of Dr. Whell, and which had occupied much of the attention of the council—that it was desirable to establish a uniform musical pitch. It remains with the committee appointed to consider and report what pitch shall be adopted in this country. A large mass of correspondence has been collected during the vacation on the subject. The address concluded with showing the vast increase in commerce, arts, and manufactures that had taken place during a recent period.

Mr. Webster, who rose to move a cordial vote of thanks to the chairman for the address just delivered, expressed his fullest confidence that the announcement of the determination of the council to organise an industrial exhibition in 1862 would be sympathised with throughout the country. He felt confident that through the progress of art and science a quinquennial exhibition might now be proceeded with, independent of the position of foreign affairs. He urged the importance of co-operation, and, in conclusion, drew attention to the present state of the law of copyright and of trade marks.

Sir W. Page Wood rose to second the motion, and return thanks for himself personally for the honour conferred on him by his nomination to fill the office so recently vacated by the lamented death of Robert Stephenson.

Several members next joined in a discussion relative to securing other premises, when, after the presentation of medals to various persons, the meeting was adjourned until next Wednesday, when Sir John Bowring will read a paper on the arts and manufactures of China.

MEETING FOR THE ENSUING WEEK.

TUESDAY.—*Inst. Civil Engineers*, Discussion "On the Government Water-Works, Trafalgar Square," and, if time permits, a paper "On Arterial Drainage and Outfalls," by R. B. Grantham, Esq., M. Inst. C.E., at 8 p.m.

Law Cases.

MIDWORTH'S PATENT BEATERS.

VICE-CHANCELLOR'S COURT, NOV. 16.—(*Before Vice-Chancellor Sir W. P. Wood.*)

GOUCHER *v.* MIDWORTH.

This was a motion for an injunction to restrain the defendant from manufacturing and selling thrashing machines with grooves or channels in the surface of the beater, in imitation of the plaintiff's patented thrashing machine, and generally from infringing his patent, which was taken out in November, 1848. The case set up by the defendants was that there was no novelty in the plaintiff's patented invention, which was in effect a mere colourable imitation of an older patent taken out by one Dry in 1842, now expired, and of which there were several modifications in constant use. The defendants also denied any infringement of the plaintiff's patent in the machines sold by them, and contended that upon their evidence the enjoyment by the plaintiff had not been so uninterrupted as to entitle him to an injunction before bringing his action, although his right to an account was not denied.

Sir Hugh Cairns and Mr. Jessel appeared in support of the motion; Mr. H. F. Bristowe opposed the motion on behalf of the defendants.

The Vice-Chancellor, after observing that even where there might be considerable doubt as to the validity of the patent, still where there had been long and undisputed enjoyment the Court would grant an injunction, though upon terms to be imposed on the plaintiff, said that the statement of the defendant as to the want of novelty in the plaintiff's invention, which had been patented as long ago as 1848, was entirely unsupported. If ever there was a case of clear and undisputed possession and enjoyment it was this. Until the matter had been actually tried at law he could not, of course, say that there might not be a case to be tried. Then as to Dry's patent, looking at the specification, anything more unlike it than the plaintiff's patent could not be suggested. At present he was very far from feeling that it was a case of strong doubt, as had been suggested by the defendants, and the injunction must be granted, the plaintiff undertaking to bring an action and abide by any order as to damages.

COAL-BURNING LOCOMOTIVES.

COURT OF QUEEN'S BENCH, Nov. 16.—(*Sittings in Banco, before Lord Chief Justice Cockburn and Justices Hill and Blackburn.*)

THE MANCHESTER, SHEFFIELD, AND LINCOLNSHIRE RAILWAY COMPANY *v.* WOOD.

This was an appeal from a conviction by the magistrates of Sheffield, whereby they had convicted the Manchester, Sheffield, and Lincolnshire Railway Company of using upon their line a locomotive engine which was not "constructed upon the principle of consuming and so as to consume its own smoke." The case stated that the engine No. 37 was seen emitting black smoke for four minutes at the Sheffield Railway station, at 4 o'clock in the morning, and afterwards, when it moved along the line, it was again seen for four minutes emitting black smoke. The company, when summoned before the magistrates contended that the engine in question was constructed on the best known principle for consuming its own smoke; but the magistrates without entering into this question considered that the fact that the engine emitted black smoke was conclusive that it was not "constructed on the principle of consuming and so as to consume its own smoke," as required by the 114th section of the 8th Victoria, cap. 20, and fined the company £5.

Mr. Quain, for the respondents, contended that the magistrates were right.

Mr. Mellish, for the appellants, contended that the magistrates ought to have gone into an inquiry as to whether or not the engine in question was constructed on the principle of consuming and so as to consume its own smoke. It might have been that the only cause of the engine's smoking was the negligence of the engine-man.

Lord Chief Justice Cockburn said the Act did not say that the company should be liable to a penalty if their engines emitted smoke; and this Court could not go beyond the Act of Parliament. The fact that the engine emitted smoke would be strong evidence that the engine was not "constructed on the principle of consuming and so as to consume its own smoke;" but it was not conclusive. The case must go back to the magistrates to inquire whether or not the smoke arose from the defective construction of the engine. If the Legislature had intended to say that the company should be liable to a penalty, under all circumstances, where an engine emitted smoke, it would have used a more stringent enactment.

Mr. Justice Hill and Mr. Justice Blackburn were of the same opinion.—Case remitted accordingly.

THEORY OF NAVAL ARCHITECTURE.

No. X.

IN the construction of ships there are, as we have already stated, two planes which may be made use of as the horizontal plane of projection: the first, that of the load water line, and the other a horizontal plane through the upper edge of the rabbet of the keel. When the plane of the load water section is taken as the horizontal plane of projection, the transverse sections being drawn perpendicular to it, the same method of calculation as that given in our first example must be followed for obtaining that portion of the displacement bounded by the extreme, horizontal and transverse vertical, sections; but since in ships which draw more water abaft than forward the plane of the load water section is not parallel to the rabbet of the keel, the lowest section cannot be made to inclose the entire displacement exclusive of the keel; there will, therefore, be an appendage between the lowest section and the bottom of the keel similar to that represented in Fig. 19, included between 5½ W. L. and the lower part of keel. Besides this the rudder and posts abaft the aftermost section must be taken when the ship is built of wood; also where the stem curves inwardly at the foot, a portion situated before the foremost section at the upper part must be added, and as its lower part is inside the extreme sections, and not terminated by them, the space between the stem and the extreme sections is assumed to be of the same thickness as the stem when measuring off the ordinates, and the portion thus taken in excess is afterwards subtracted from the result first obtained.

Our former example and the above observations will, therefore, be sufficient to explain the method of performing the calculations in any case where the plane of the load water line is taken as the horizontal plane of projection.

The adoption of the plane of the load water section as the horizontal plane of projection is obviously the most simple for making the ordinary calculations, but it is open to the following objection:—When the building draught has to be made it is necessary to take the horizontal plane through the upper edge of the rabbet of the keel as the plane of projection, consequently there is a large amount of labour necessary to shift the planes of projection in addition to the operation of taking off the planking; constructors, therefore, who have little time to spare, first complete their building draught, and afterwards put on the planking, for the purposes of calculation retaining the same planes of projection. It is evident, therefore, that the curves drawn in the half-breadth plan are the projections of the several horizontal sections of the ship on a plane inclined to their planes; and further that transverse sections drawn perpendicular to the load water section would not be represented, in the half-breadth plan, by straight lines perpendicular to the middle line, but by curves, in obtaining which much time would be expended. The projections of the horizontal sections are, however, made use of for the purposes of calculation, and, as we shall prove, the displacement so found is essentially correct.

We shall, therefore, assume that the planes of projection are those generally made use of for the building draughts, and that the curves in the half-breadth represent the projections of the horizontal sections of the ship at the outside of the planking. And by way of example we will perform the calculations for a ship of war of the following dimensions:—

Length between the perpendiculars..		180′ 0″
„ of the keel for tonnage		160′ 7½″
Breadth, extreme		28′ 4″
„ for tonnage		28′ 0″
„ moulded		27′ 6″
Depth in the hold.....		16′ 0″
Burthen in tons No.		670
Draught of water	Forward.....	12 feet.
	Abaft	14 „

Our object now will be to obtain the areas of the curvilinear figures on the half-breadth plan. For this purpose the foremost and aftermost sec-

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Distance between the Vertical Sections 9·4 feet; Ditto between the Horizontal Sections 2·65 feet.

Ordinates.	Multipliers.	5½ W. L.		5 W. L.		4½ W. L.		4 W. L.		3 W. L.		2 W. L.		L. W. L.	
		1		3		3		3		6		6		2	
1	½	·4 ·4	·2	·4 1·2	·2	·4 1·2	·2	·4 1·2	·2	·4 2·4	·2	·4 2·4	·2	·6 1·2	·3
1½	2	·4 ·4	·8	·4 1·2	·8	·4 1·2	·8	·5 1·5	1·0	·9 5·4	1·8	1·5 9·0	3·0	2·3 4·6	4·6
2	1½	·4 ·4	·6	·4 1·2	·6	·7 2·1	1·05	1·0 3·0	1·5	1·7 10·2	2·55	2·7 16·2	4·05	4·0 8·0	6·0
3	4	·4 ·4	1·6	·8 2·4	3·2	1·3 3·9	5·2	1·9 5·7	7·6	3·6 21·6	14·4	5·5 33·0	22·0	7·4 14·8	29·6
4	2	·4 ·4	·8	1·1 3·3	2·2	2·1 6·3	4·2	3·1 9·3	6·2	5·8 34·8	11·6	8·2 49·2	16·4	10·1 20·2	20·2
5	4	·4 ·4	1·6	1·5 4·5	6·0	3·1 9·3	12·4	4·6 13·8	18·4	8·0 48·0	32·0	10·5 63·0	42·0	12·1 24·2	48·4
6	2	·4 ·4	·8	1·7 5·1	3·4	4·2 12·6	8·4	6·3 18·9	12·6	10·1 60·6	20·2	12·2 73·2	24·4	13·2 26·4	26·4
7	4	·5 ·5	2·0	1·9 5·7	7·6	5·2 15·6	20·8	8·0 24·0	32·0	11·6 69·6	46·4	13·2 79·2	52·8	13·8 27·6	55·2
8	2	·6 ·6	1·2	2·4 7·2	4·8	6·1 18·3	12·2	9·3 27·9	18·6	12·6 75·6	25·2	13·7 82·2	27·4	14·0 28·0	28·0
9	4	·8 ·8	3·2	3·1 9·3	12·4	6·8 20·4	27·2	10·1 30·3	40·4	13·1 78·6	52·4	13·9 83·4	55·6	14·1 28·2	56·4
10	2	·8 ·8	1·6	3·3 9·9	6·6	6·9 20·7	13·8	10·3 30·9	20·6	13·2 79·2	26·4	14·0 84·0	28·0	14·2 28·4	28·4
11	4	·8 ·8	3·2	3·3 9·9	13·2	6·7 20·1	26·8	10·2 30·6	40·8	13·2 79·2	52·8	14·0 84·0	56·0	14·2 28·4	56·8
12	2	·8 ·8	1·6	3·0 9·0	6·0	6·3 18·9	12·6	9·4 28·2	18·8	13·0 78·0	26·0	13·9 83·4	27·8	14·1 28·2	28·2
13	4	·8 ·8	3·2	2·5 7·5	10·0	5·2 15·6	20·8	8·2 24·6	32·8	12·2 73·2	48·8	13·6 81·6	54·4	14·0 28·0	56·0
14	2	·8 ·8	1·6	2·0 6·0	4·0	4·0 12·0	8·0	6·5 19·5	13·0	10·9 65·4	21·8	13·0 78·0	26·0	13·7 27·4	27·4
15	4	·8 ·8	3·2	1·5 4·5	6·0	2·7 8·1	10·8	4·6 13·8	18·4	9·0 54·0	36·0	12·1 72·6	48·4	13·3 26·6	53·2
16	2	·7 ·7	1·4	1·1 3·3	2·2	1·7 5·1	3·4	2·8 8·4	5·6	6·4 38·4	12·8	10·2 61·2	20·4	12·5 25·0	25·0
17	4	·6 ·6	2·4	·7 2·1	2·8	1·0 3·0	4·0	1·6 4·8	6·4	4·0 24·0	16·0	7·5 45·0	30·0	11·2 22·4	44·8
18	1½	·5 ·5	·75	·5 1·5	·75	·6 1·8	·9	·8 2·4	1·2	1·9 11·4	2·85	4·4 26·4	6·6	8·5 17·0	12·75
18½	2	·4 ·4	·8	·4 1·2	·8	·5 1·5	1·0	·6 1·8	1·2	1·2 7·2	2·4	2·6 15·6	5·2	6·2 12·4	12·4
19	½	·4 ·4	·2	·4 1·2	·2	·4 1·2	·2	·4 1·2	·2	·4 2·4	·2	·6 3·6	·3	2·7 5·4	1·35
		32·75 1		93·75 3		194·75 3		297·5 3		452·8 6		550·95 6		621·4 2	
9056·05		32·75 4½		281·25 4		584·25 3½		892·5 3		2716·8 2		3305·7 1		1242·8 0	
14734·05 2·65		147·375		1125·0		2044·875		2677·5		5433·6		3305·7		0	

Vertical Sections.				Metacentre.	
Areas.	Multiples of areas.	Multipliers.	Moments.	Cubes.	Multiples of cubes.
10·0	5·0	0	0	·2	·1
23·3	46·6	½	23·3	12·2	24·4
41·1	61·65	1	61·65	64·0	96·0
81·8	327·2	2	654·4	405·2	1620·8
123·5	247·0	3	841·0	1030·3	2060·6
163·2	652·8	4	2611·2	1771·6	7086·4
197·2	394·4	5	1972·0	2360·0	4600·0
222·2	888·8	6	5332·8	2628·1	10512·4
239·8	479·6	7	3357·2	2744·0	5488·0
251·0	1004·0	8	8032·0	2803·2	11212·8
253·9	507·8	9	4570·2	2863·3	5726·6
253·0	1012·0	10	10120·0	2863·3	11453·2
246·5	493·0	11	5423·0	2803·2	5606·4
231·3	925·2	12	11102·4	2744·0	10976·0
209·1	418·2	13	5436·6	2571·4	5142·8
180·4	721·6	14	10102·4	2352·6	9410·4
142·1	284·2	15	4263·0	1953·1	3906·2
101·9	407·6	16	6521·6	1404·9	5619·6
61·0	91·5	17	1555·5	614·1	921·2
40·1	80·2	17½	1403·5	238·3	476·6
15·4	7·7	18	138·6	19·7	9·8

39045·2325(					1487·5 3622·4	297·5 1811·2
4·3115 ·0485 apps.	163·75 750·0				5109·9 550·95	550·95
4·3600 ft.	913·75 194·75		32·75 281·25		4558·95 2·65	2659·65 2·65
Cr. of Buoyancy below L. W. L.	719·0 2·65	32·75 375·00 194·75	584·25 297·5		12081·2175 9·4	7048·0725 9·4
621·4 9·4	1905·35 9·4	602·50 2·65	1195·75 2·65		9)113563·4445	66251·8815 2
5841·16 2	9)17910·29	1596·625 9·4	3168·7375 9·4		2)12618·1605	9)132503·763
3)11682·32	4)1990·032	9)15008·275	8)29786·1325		6309·0802 14	14722·6403 28
7)3894·106 area.	497·508 167·0	1667·586 167·00	3723·2665 167·		7)6323·0802	7)14750·6403
5)556·3009	7)664·508	7)1834·586	7)3890·2665		5)903·2971	5)2107·2343
12)111·2602	5)94·9297	5)262·084	5)555·7523		180·6594 111·1504	421·4168 111·1504
9·2717	18·9859	52·417	111·1504		291·8098	532·5972
Tons per inch immersion at L. W. L.	Dispt. to 5 W. L.	Dispt. to 4½ W. L.	Dispt. to 4 W. L.		Dispt. to 3 W. L.	Dispt. to 2 W. L.

9056·05 2·65	83522·35 9·4	1012950·3 9·4
23998·5375 9·4	)785110·09	958332·82 2
	86·69 81·6	9)1916665·64
8)225586·2055	2·09 feet ·34 app.	)212962·85(
28198·2757 209·2 app.	Centre of buoyancy abaft (10).	7·4968 ft. 4·36
7)28407·4757	2·43	3·1368
5)1058·2108	253·9 2·65	Metacentre above L. W. L.
811·6421	672·835 3	
Dispt. to L.W.L.	8)2018·505	
	252·3131 1·1 appendage.	
	253·4131 area of Mid. Sec. to L. W. L.	

Appendages.

	Cubic ft.	Ct. of gr. from (1).	Ct. of gr. from L.W.L.
Keel piece.....	167	 120	..... 12·5
Rudder and post	65	 180	..... 6·25
Neg. ap. forw....	22·8	..... 2·5	..... 9·5

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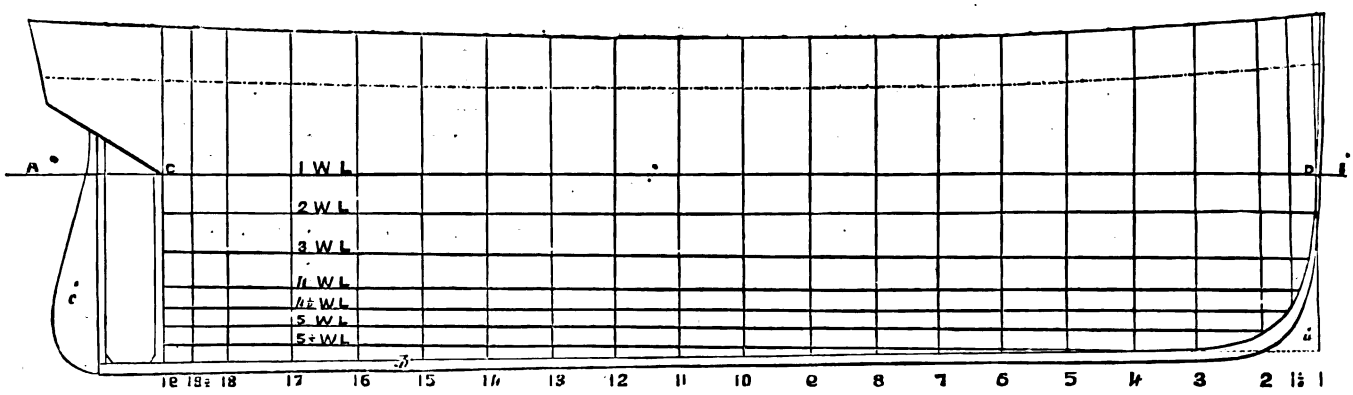
FIG. 19.



tions or ordinates are placed at the rabbets of the stem and post, as before explained; and the distance between them, measured on the middle line of the half-breadth plan, is divided into a number of equal portions suitable for the application of the rules given for obtaining curvilinear areas, and at the points of division lines are drawn perpendicular to the middle line. These lines represent transverse sections perpendicular to the upper edge of the rabbet of the keel, and in Fig. 19 are represented by the vertical sections 1, 1½, 2, &c. The ordinates are then measured off from the half-breadth plan, and inserted in the table, as already described in our former example. and the calculations proceeded with as though the transverse sections were perpendicular to the load water sections.

In our present example, the distance between the extreme vertical sections measured on the middle line is divided into 18 equal portions, each being 9·4 feet; and for greater accuracy, the two extreme intervals are again divided into two equal portions respectively, as is shown in the Fig. 19.

In placing the horizontal sections they are so arranged that the third rule for approximating the curvilinear areas may be applied. There are at the upper portion of the displacement four equidistant sections, and at the lower portion four other equidistant sections. The common distance between the sections L. W. L. and 2 W. L.; 2 W. L. and 3 W. L.; 3 W. L. and 4 W. L., is 2·65 feet, measured on the sections drawn perpendicular to the rabbet of the keel, and the common distance between the sections 4 W. L. and 4½ W. L; 4½ W. L. and 5 W. L.; 5 W. L. and 5½ W. L. is $\frac{2{\cdot}65}{2}$ feet, measured on the same sections.

Performing the calculations in the same manner as described in the former example, we obtain first the areas of the projections of the several horizontal sections; and before being multiplied by ⅓rd of the common interval they are to be found in the first horizontal column below the ordinates; they are 32·75, 93·75, 194·75, 297·5, 452·8. 550·95, and 621·4. Suppose we have multiplied these results respectively by one-third of the common interval, and so obtained the areas of the projections of the several horizontal sections, these areas will be equal to the true areas of the respective sections, multiplied by the fraction $\frac{l}{L}$, L being the distance between any two vertical sections, measured on a horizontal section, and l the distance between them measured on the middle line of the half-breadth plan; the true area of any horizontal section may therefore be readily found from these areas given in our table. Generally, however, the fraction $\frac{l}{L}$ is so near unity that the areas found in the table may be taken as the true areas of the sections, without any practical error; and it is only in cases in which the difference of draught of water forward and aft is very considerable in proportion to the length of the ship, that the multiplication by the fraction will be necessary.

Let us assume, however, that we have obtained the true areas of the horizontal sections, and let them be respectively represented by A_1, A_2, A_3, A_4, $A_{4\frac{1}{2}}$, A_5, and $A_{5\frac{1}{2}}$.

To obtain the displacement from these we have only to multiply them respectively by 2, 6, 6, 3, 3, 3, 3, and 1, in accordance with the third rule for finding a curvilinear area, and their sum multiplied by ⅜ths of the perpendicular distance between the sections, will give the displacement. Now, the perpendicular distance between any two sections is equal to the distance between them, measured on a vertical section, multiplied by the fraction $\frac{l}{L}$: it is obvious, therefore, that if we make use of the projections of the areas of the horizontal sections (which are the true areas multiplied by the fraction $\frac{l}{L}$) and take the distances between the horizontal sections, as measured on a vertical section, we shall obtain the correct displacement.

To obtain the displacement by *transverse sections*, the rationale of the operations will be readily made out. For, since the common interval between the horizontal sections is measured along the transverse sections in the sheer plan, when the ordinates for any section are put into the rule, and the sum multiplied by the proper fraction of the common interval, the result will be the true area of that section. And since the common interval between the transverse sections is the perpendicular distance between any two consecutive ones; when their areas are put into the rule, and the sum multiplied by the usual fraction of the common interval, the result will evidently be the displacement.

Another explanation may be given of the manner of finding the displacement inclosed by the extreme sections from the projections of the outside of the planking, as delineated on the *building draught*. Taking, as before, the extreme transverse sections at the outside of the rabbet of the stem and stern-post at the load water line, let the distance between them be measured on the L. W. L. in the sheer plan, and then divided into the same number of equal parts as was the distance between them on the middle line of the half-breadth plan, and through the points of division let transverse sections be drawn perpendicular to the upper edge of the rabbet of the keel; these sections will, of course, coincide with those before drawn, but since the common interval is measured on the horizontal sections, the true areas of the horizontal sections will be found on the table, and not their projections as before. Again, the common interval between the horizontal sections must now be measured perpendicularly to them, and not along the transverse sections, as in the former case; it is easy to see, therefore, that the true displacement will in the end be arrived at by the *horizontal sections*.

To proceed with the transverse sections we shall first have their projections on a plane perpendicular to the load water line, and not their true areas, but as before the true displacement will be obtained when these are put into the rule, and the common interval taken as measured along the horizontal sections.

With these observations, we shall leave the student to work out the example for himself, as no difficulty can present itself respecting that portion of the displacement which is inclosed by the extreme sections; the work is precisely the same as in our former example.

The small portions of the displacement situated outside of the extreme sections are found by the ordinary rules of mensuration, as also are their centres of gravity, and the necessary corrections are made in the results before obtained.

In the present example the portion below 5½ W. L. contains 167 cubic feet, and its centre of gravity, situated at *b*, Fig. 19, is 120 feet from section 1, and 12·5 feet from the L. W. L.

The contents of the rudder and stern posts abaft the section 19 are 65 cubic feet, and the centre of gravity situated at *c*, Fig. 19, is 180 feet abaft section 1, and 6·25 feet below L. W. L.

The portion between the stem and the extreme sections, which must be subtracted, contains 22·8 cubic feet, and its centre of gravity, situated at *a*, Fig. 19, is 2·5 feet abaft section 1, and 9·5 feet below L. W. L.

The positive portions amount to 167 + 65. or 232 cubic feet. The negative portion is 22·8; the total positive appendage is therefore 209·2 cubic feet, which must be added to 28198·2757, the displacement situated between the extreme sections, to obtain the total displacement. In forming the scale of displacement, the proper appendages must also be taken into the calculations.

Again, in obtaining the centre of buoyancy in our former example, there were no appendages to the displacement. In the present case, the centre of buoyancy corresponding to the portion inclosed by the extreme sections is found as in that example, and it then remains to find the effect of the appendages upon its position in a vertical and also in a horizontal direction. This may be readily done by means of the property of the centre of gravity proved in our last article, page 215. Assume that the axes $o\,x$, $o\,y$ both pass through the centre of gravity, above found, of the displacement inclosed by the extreme sections, and that they are parallel to L. W. L. and section 1, then we have only to find the moments of the appendages about ox and oy.

On reference to the table it will be found that the centre of buoyancy without the appendages is 4·3115 feet from the L. W. L. and 86·69 feet from section 1; consequently the centre of gravity of the keel piece is 12·5—4·3115, or 8·1885 feet from the L. W. L.; therefore 167 × 8·1885 = 1367·5 is the product of its weight and distance from $o\,x$, also 6·25—4·3115 = 1·9385 is the distance of the centre of gravity of the rudder and posts from $o\,x$; and 9·5—4·3115 = 5·1885 is the distance of the negative portion forward from the same axis,

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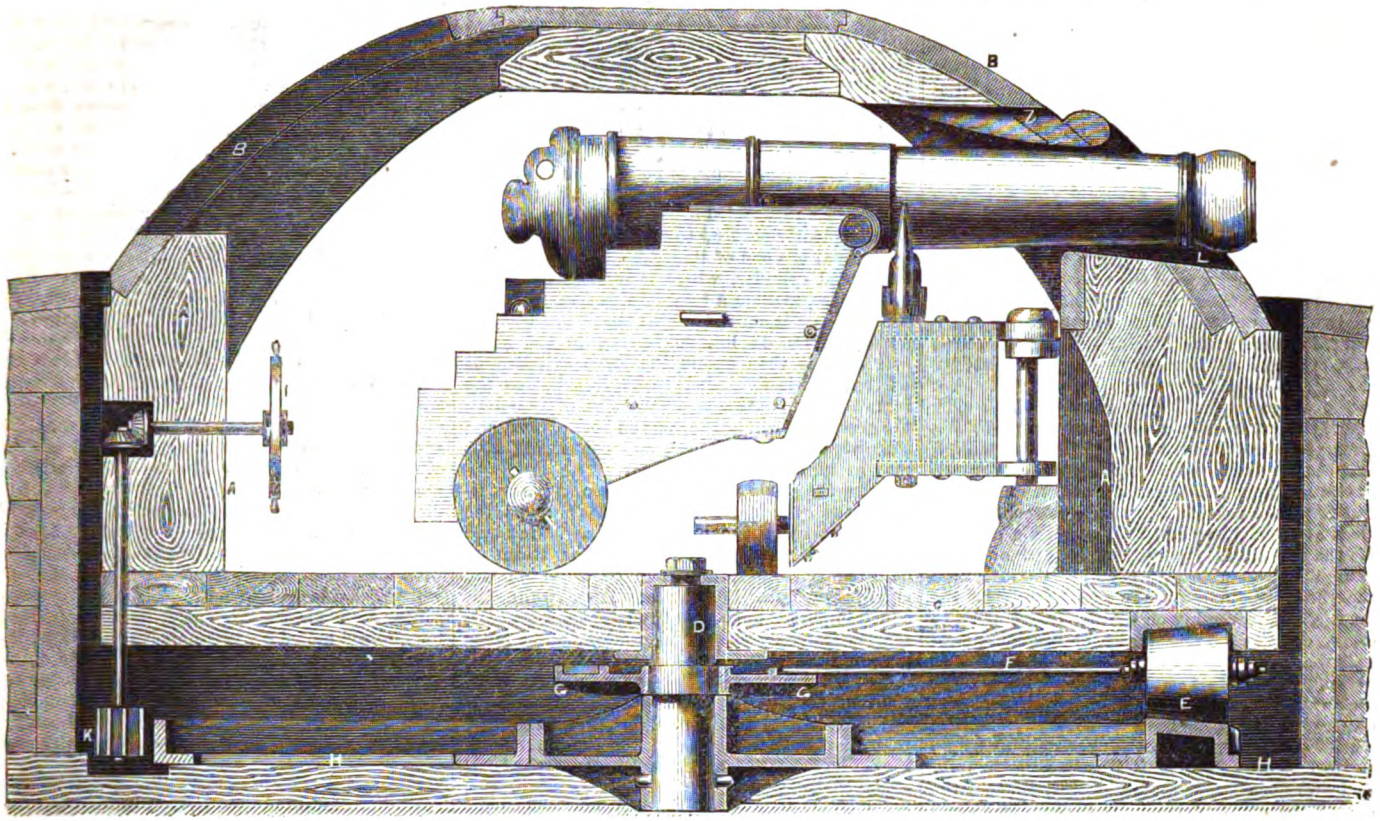
CAPTAIN COLES' PATENT SHIELDS FOR ORDNANCE.



therefore 65 × 1·9385=126·0, and 22·8 × 5·1885= 118·3; the sum of the positive products is 1493·5, and the negative product 118·3, the result will therefore be positive, and equal to 1375·2. This quantity divided by 28407, the total displacement in cubic feet, including appendages, will give ·0485 feet for the distance of the centre of buoyancy below that corresponding to the displacement between the extreme sections, or the centre of buoyancy below L. W. L. is 4·36 feet. In a similar manner, the distance that the centre of buoyancy moves aft by the addition of the appendages may be found to be ·34 feet, as given in the table. The centre of buoyancy is therefore 87·03 feet abaft section 1, when the appendages are taken into account.

The student will now, we think, be able to make the ordinary calculations for any ship, with either of the usual horizontal planes for the plane of projection, and in the above example he will complete for himself the drawing containing the scale of displacement, the scale of the area of the midship section, and that of the tons per such immersion similar to those given on page 298, vol. I., for our first example.

MONSTER TROOP STEAMER.—The following paragraph has been communicated:—Messrs. Pearse and Co., Stockton, have on the stocks for the Government an Indian river steamer of immense proportions. Her length in the water-line is 350 feet, over all 375, and breadth 46 feet. She is by far the largest river steamer in the world. Her engines are 200 horse power. She will be impelled by paddles, and will, it is expected, attain a speed of 13 miles an hour. She will be fitted with sleeping berths and every suitable sanitary arrangement for about 800 soldiers. She will be guided by two large patent steering blades, and is made to draw only two feet of water, even with all her stores, fuel, and 800 passengers on board. She is flat-bottomed of course, and weighs about 370 tons. She will be completed in about a month, and will then be fitted up on the Thames, in order to make an experimental trip.

CAPTAIN COLES' PATENT SHIELDS FOR ORDNANCE.

CAPTAIN COWPER PHIPPS COLES, R.N., has recently patented an apparatus for defending guns and gunners in ships of war, gunboats, and land batteries. His invention consists of a large convex shield covered all over its exposed portion with thick iron or other metal, and mounted upon a platform or frame which is capable of revolving after the manner of a turntable, and which also carries the gun upon any suitable carriage. An aperture is formed in the shield to allow the muzzle of the gun to pass through it, and this aperture is somewhat larger vertically than horizontally in order to admit of the elevation and depression of the gun, the lateral aim being secured by the rotation of the platform. Captain Coles does not limit himself to any precise form or mode of construction, but he usually prefers to make the shield hemi-spherical, and to construct it of a wooden frame with timbers in vertical planes placed close together, the whole being covered with thick iron plates. In the engravings hereunto annexed, we have illustrated the manner in which he carries his invention into effect. The figure is a transverse section of a shield, constructed according to his invention, and adapted to a land fort or battery. The body of the shield is composed of a compact framing of timber *A*, the whole exposed upper portion of which is covered with thick iron plates *B*. The shield is built upon a revolving timber platform or frame *C*, which turns about a central bolt or stud *D*, and runs upon conical rollers *E*, placed beneath it near its circumference. These rollers are carried by arms *F*, which are attached to a loose running central ring *G*. The conical rollers *E*, run upon a metallic rail or tram, supported by a floor or platform *H*. The rotary motion which is requisite in the training of the gun is obtained by means of a hand-wheel *I*, fitted within the shield and connected with gearing, which works a pinion *K*, that travels round in teeth or cogs formed upon the circumference of the metallic rail or tram. *L* is the aperture through which the gun protrudes. The aperture *L* is only sufficiently wide to allow the muzzle of the gun to pass through it, but is of sufficient size vertically to allow of the depression and elevation of the piece. A narrow aperture *l* is continued up from the main aperture *L*, to admit of the gunner "sighting" the gun with ease and accuracy. When the shield is formed and fitted as shown in the engraving, the ammunition must be supplied through an aperture made for the purpose in the rear of the shield. But in some cases, as on board ship for example, Captain Coles prefers to employ a hollow cylindrical casing in place of the solid central bolt or stud *D*, and pass the ammunition up from below through it. In like manner he proposes in other cases to modify other details of the apparatus. Instead of making the shield of an arched or curved form, for instance, he makes it polygonal in horizontal section, and straight-sided in vertical section, or of any other prismatic or other form, which will present a convex or inclined surface throughout to shot and shell. He likewise sometimes mounts the shield upon spherical balls, or rollers, or otherwise, instead of upon the conical rollers before described, and in place of the hand wheel and gearing for rotating it, he employs any other suitable appliances for the purpose. Further, he provides for the escape of smoke from the shield, and for its ventilation, by forming apertures in it for the purpose, and sometimes (as where a central upward passage is provided for the ammunition) by forcing air continually through the shield by means of a fan placed beneath it. Finally, he proposes to form the shield large enough in some cases to cover two or even more than two guns side by side and parallel to each other. When the shield is employed on board ship it should be either built or placed somewhat eccentrically in order that the common centre of gravity of the shield and the gun or guns beneath it may be caused to fall in the centre, about which the whole rotates. This will prevent the same from having any disposition to rotate imparted to it by gravity as the ship rolls or pitches. Captain Coles prefers to mount the guns placed beneath the shield upon

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carriages resembling that invented by Mr. Marshall in 1827, but modified to suit the purpose more effectually. We have no account of the manner in which this modification of the carriage is to be effected, and have consequently had engraved within the shield a gun and carriage taken from Commander Marshall's original description of 1827. The following account of this part of the engraving is derived from the same source. "*A* is the breech carriage,* which differs only from the ordinary carriage in its shape before, which will be understood sufficiently by the drawing; *B* is the coin; *C* is the trunnion, and *D* the asp over the trunnion; *E*, is the muzzle carriage, having its wheel or wheels *F*, in this position at right angles with the wheels of the breech carriage; *E* is a mere solid block of wood; *G*, *H* are two plates bolted to it with eyes at one end *r* and *t*, to receive the hinged bolt *J*; this bolt passes through another eye *s*, which is bolted to the ship's sides and steps into a socket made for it in the water ways; *K* represents the ship's side, and *L* the water ways, and *n* the socket; *N* is a strong iron crutch, with a piece of hard wood *i*, *i*, fitted in the middle of it for the muzzle of the gun to traverse upon; this crutch turns on the central bolt or pivot *P*, which is set into a socket made for it in the block or bed of the muzzle carriage *E*; the gun is here supposed to be run out in a straight direction for firing, and if it were fired the recoil would cause the gun to run in the muzzle, and traversing on the wood *i*, *i*, till the crutch came to the muzzle rim, or beyond it if required according to the lengths of the ropes or breechings. By this arrangement a hand spike or tackle applied to the muzzle carriage at *X*, on either side, will point the gun with the greatest nicety and facility, the wheel or wheels *F* being, as will be observed, in the proper position for that movement." It should be observed that the characteristic feature of Commander Marshall's carriage consisted in mounting the breech and muzzle of a gun on two separate carriages, one supporting the breech and the other the muzzle, and the wheels of one being at an angle with those of the other.

* We here preserve Mr. Marshall's language, but without reproducing the letters of reference in the engraving.

DOUBLE CYLINDER EXPANSION MARINE ENGINES.

AT last year's meeting of the British Association, Mr. John Elder, Engineer, of Glasgow, gave a description, with plans, of the various double cylinder expansion marine engines for ocean steamships that had been constructed by his firm during the last six years. At the late Aberdeen meeting he added those of the Callao, Lima, and Bogota, together with those of some others now in progress. Before entering on this subject he reminded the Association that these engines are constructed with the view of getting the greatest amount of power from a given quantity of steam, at a given pressure, with less total weight of engine-boilers and water, and occupying less total space than that occupied by the ordinary class of steam-engines on board of steam-ships. At the former meeting he had mentioned that the above steam-ships, with the ordinary first class system of machinery, were coming from Valparaiso to this country to have their engines replaced by these double-cylinder engines, entirely for the purpose of saving of fuel—the Lima and Bogota. They are of the following dimensions:—Length, 245 feet; breadth, 36 feet; depth, 23 feet; breadth between paddle-boxes, 86 feet; tonnage, 1,650 tons. These ships had formerly a full poop and forecastle, which were altered this year into a spar deck, and the hulls of the ship increased in weight about 120 tons; the cabin and hold accommodation was lengthened 30 feet by the space saved by the smaller quantity of coal and boiler space required for the new machinery; and the registered tonnage of the ship was increased by upwards of 400 tons. The following statements are in the language of Mr. Elder.

In the engines of the Lima, Callao, and Bogota, the cylinder capacity is so great as to admit of the steam being expanded to within two pounds of the pressure in the condenser at the end of the stroke, while the engines are working full power; and as the nominal power of these engines is contracted to be 320, the cylinders are 90 in. diameter, and 5 feet stroke; and, in order to reduce the violent shock of high-pressure steam on such a large piston, and also to increase the jacket surfaces, a cylinder of one-third the size, or 25in. diameter, and 5 feet stroke, is placed close to it. This small cylinder receives the steam direct from the boiler during one-third of its stroke; this steam is consequently reduced to one-third of its original pressure at the end of its stroke, and then enters the second cylinder, where it is expanded three times more, making a total of nine volumes. Thus 42 lbs. steam is expanded nine times, or to 4¾ lbs., namely, from 42 lbs. to 14 lbs. in the small cylinder; it then enters the large cylinder at 14 lbs., and is expanded to 4¾ lbs., but as the second piston is three times the size of the first, the gross load will be the same on both pistons, and the piston rods, crossheads, and connecting rods may be duplicates of each other.

From the above pressures of steam at the entering of the cylinder, it is evident, that unless the inside surface of the large cylinder is retained about 210 degrees, condensation of the steam on entering is certain, and such condensation will chiefly evaporate into the condenser while the eduction port is open, and the latent heat necessary to evaporate such condensation will be much greater than what would have radiated from the hot cylinder to the condenser, had no condensation taken place; and such heat would be entirely lost. In the same manner it might be mentioned, that the inside surface of the small cylinder should be retained as high in temperature as the steam that enters it; and in order to attain this object every effort should be made in the construction of steam machinery. It is evident that, for the small cylinder, superheated steam is absolutely necessary for this purpose, either in the jacket or cisterns of the cylinder; and in the large cylinder the temperature of steam direct from the boiler to the cylinder may be sufficient, if communicated through a large enough pipe or aperture.

In the engines under description the pipe supplying steam to the jackets was 2½ in. diameter, and the steam was superheated to upwards of 400 degrees that entered the jacket. It was found that a large supply to the jacket saved a vast quantity of heat, which can only be explained by the principles above mentioned, namely, that any quantity of heat supplied to the jackets assisted in proportion to the quantity of latent heat it saved being evaporated to the condenser during the eduction of the steam, and if the pipes to the jackets were large enough, or sufficient to prevent the condensation referred to, the economy of the machinery was realized to the greatest extent.

Mr. Elder called the attention of all parties concerned to the performance of Cornish pumping engines, and more particularly to the similarity of action of the steam jacket in these engines to the principle of that of the double cylinder engine with steam jackets. In the Cornish engine the piston it is single acting, and the jacket has twice the time to do its work, or rather the steam in the cylinder is twice the time in contact with the jackets that it is generally with Watt's engine, also that the Cornish engines have very large jacket surfaces in proportion to the power developed. With these features in view, the engineers constructed the engines now under discussion, and to this cause may be attributed a considerable portion of their success, and to the non-observance of these features the almost total failure of economy in the expansive working of most steam engines on board of steamships, namely, by constructing large engines, going slow, without steam jackets, or superheating of steam; such engines would, of course, present a most favourable opportunity for improvement by adding any mode of superheating apparatus.

In the Cunard line, and many of our ocean steamers where very high steam chests and large hot uptakes pass up through the steam, the economy of expansion has never been questioned, but can be substantiated to a considerable extent at any time. It is likely, however, that were the temperature of the steam from such boilers ascertained, it would be found considerably superheated. And the use of the various modes of superheating has been rendered much more necessary than it otherwise would have been, by engineers generally following that type of tubular boiler used by the Admiralty where there are low steam chests, and short uptakes, said to be rendered necessary in the case of the Admiralty on account of exposure to shot.

From the foregoing it is also conclusive that with the ordinary construction of steam-engines afloat, that small engines going fast would consume less coal per indicated horse-power than large engines going slow; but with engines such as those of the Callao, Bogota, and Lima the converse will be the case, carried, of course, to within moderate limits.

Again, to return to the case of the Callao, Lima, and Bogota, the general construction of the engines and boilers are as follows:—The cylinders are four in number, namely, two of 62 inches diameter, and two of 90 inches diameter and 5 feet stroke. The cylinders lie diagonally to each other. The steam and eduction valves are wrought with eccentrics, the steam valve is a gridiron valve with a large lap; one eduction valve serves as eduction for the high and its corresponding lowspressed cylinder; it has no lap, and the eduction port remains open during the entire stroke of the piston, thereby giving a free egress for the steam, and ample escape for water should it form.

In reversing the engines the eccentrics are made to overrun the engines by a donkey-engine till they arrive at the backing position—a plan which is less likely to cause accident than the ordinary methods. This donkey-engine has been found to be most satisfactory in its application.

The boilers are tubular, two in number, with iron tubes. Each boiler has three furnaces, 3 feet 4 inches wide, and 6½ feet long, or making an aggregate of 130 square feet of fire-grate. The tubes are of iron, 288 in number, 4 inches inside diameter, and 6½ feet long. Each vessel has an oval steam chest, 12 feet high, and 8 feet long, and 5 feet broad, with three uptakes through this steam chest each 2 feet diameter and 15 feet long. This makes a strong form of take-up where it joins the tube plate, especially in boilers firing across the ship; the feed-pipe of the boilers enters into a long flat tank or shield in front of the furnaces in which the furnace doors are formed. This shield forms a protection to the firemen from heat, and makes the heat, otherwise lost, available for the feed-water. In the Callao there is a third coil of feed-pipe in the funnel, to heat the feed-water. Such, then, are the leading features of this machinery, and the results are as follows:—

This plan of the boilers gave steam to the engines superheated to about 400 degrees by the uptakes, showing that the various systems of superheating are unnecessarily complicated: indeed, in the Lima, the steam got so far above 400 degrees, that in the Bogota the steam chests were made two feet lower, and two small feed-pipes were made to feed the boiler when too much superheated by the tap of the steam chest. The superheated steam, though upwards of 400 degrees of heat, was found quite inadequate to prevent condensation in the cylinder, without the steam-jacket cock being full open.

Mr. Elder pressed this fact on notice, as in the case of double-cylinder engines it is so prominently observed, by comparing the respective diagrams of the low and high-pressed cylinders, especially as those engines, where the cylinders are so close that the diagram of one is an exact counterpart of the other, when there is no condensation: and it is somewhat curious to observe, while taking diagrams of the low pressure cylinder, the gradual development of the diagram, with the jacket-cock full open, compared with that when it is shut.

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When the steam was at a pressure of 21 pounds above the atmosphere the temperature at the surface of the water was 264 degs., and at the top of the steam chest 400 degs. Faht., showing that the steam was surcharged to the extent of 136 degs., notwithstanding that the steam was in direct and unimpeded contact with the surface of the water. The engines made during the trial trips, which were generally half-a-day in length, from about 23 to 26 revolutions, and indicated from 1,000 to 1,300 horse-power during that time, and consumed from 20 to 25 cwts. per hour, with the surface blow-off cocks open. The Callao, Lima, and Bogota have all shown a consumption of from 2 to 2½ pounds per indicated horse-power per hour best Welsh coals, and the speed of the ships from 12½ to 13 knots per hour.

The steam-ship Callao has now been plying between Valparaiso and Panama with Her Majesty's mails for upwards of nine months, and has performed her work in a most satisfactory manner. The distance between these is upwards of 3,200 miles, and this she performs regularly on about 300 tons of coals. The Callao made the run from Liverpool to Valparaiso in, I think, about 36 days steaming time, which averages about 240 miles per day during a run of 9,000 miles on a consumption of about 20 cwts. per hour. The Lima has also arrived at her destination after a most successful run; she performed the distance of 1,500 miles, from Valparaiso to Callao, in 141 hours, consuming 150 tons of coals, logging at an average of 260 miles per day during that distance, considerably faster than she had ever done with her original engines, and on less than half the coals consumed. The Bogota was completed and tested on the first of September last, and found fully equal to the others. She made the run from the Cloch Light in the Clyde to the Hell Buoy at Liverpool in 15 hours, against a strong head wind, and consumed during that distance 15 tons of Scotch coals.

At the Admiralty trial, which took place immediately on her arrival at Liverpool, she averaged upwards of 13 knots, the engine made 25¼ revolutions; she indicated 1·080 horse-power, and consumed about 21 cwts. per hour of Scotch coals; the steam was superheated to 340 degrees on entering the cylinder, and the thermometer at the water level of the boiler showed 264; the pressure in the boilers was 27 lbs., and the vacuum in the condensers 26 inches. She left Liverpool for Valparaiso on the 11th of the present month, with sufficient coals to carry her 5,000 miles at 240 miles per day, and a full complement of stores for the passengers on board; her draught of water on leaving Liverpool at the load line was, aft, 14 ft. 6 in.; forward, 13 ft. 9 in.; and displacement, 1,700 tons. She steamed to the Holyhead Light, where the pilot left her, at the rate of 11¦ nautical miles per hour against a strong head wind; the engines were making 20 revolutions; the steam pressure was 26 lbs.; the vacuum 26 inches; and the consumption of coals 22 cwts. best Welsh coals per hour.

The engineers are now constructing the machinery for three other steam-ships on this principle, with boilers on the cellular cylindrical spiral principle. In conclusion, the form of engines now described gives regularity of motion, while working expansively to the fullest extent, the expansion principle is fully realised, and the engines are of a strong architectural figure, with the various parts easily got at, and reduced to simple forms, and present every facility for reversing freely by the engine-driver.

The performance of the Lima on a trial trip of considerable distance, namely, between Liverpool and Dublin, was made several months ago, under the observation of a member of the Steamship Performance Committee, appointed by the British Association at its last meeting at Leeds.

The member watched the performance of the ship and her machinery with the utmost minuteness, in conjunction with the Admiralty engineer; and an accurate return has been made to the committee, in accordance with the form prescribed and recommended for general adoption; and it will be found on reference to the Report of the Committee on Steamship Performance, presented to the Association a few days ago, that all the dimensions and particulars of performance of the Lima are embodied therein.

The recorded performances of the Lima was not a mere *measured mile trial*, which may always be made to appear more favourable than practical experience afterwards attains, but was such an extended trial as the committee had previously recommended, and which recommendation was adopted by the Directors of the Pacific Steamship Company, the owners of the Lima.

SILAS'S MARINE LIGHTS.

MR. FERDINAND SILAS, inventor of the indestructible lights applicable for telegraphic purposes at sea, and also to point out the presence of life-buoys in case of shipwrecks or other such disasters, and which were exhibited for the approval of the Lords of the Admiralty in September last, in the presence of Commodore the Hon. Sir James Drummond, C.B., and the officers of Woolwich Dockyard, last night performed a course of experiments at Blackwall for the satisfaction of Admiral M'Hardy, Capt. F. R. Ward, members of the Royal National Lifeboat Institution Committee; Capt. Robertson, Surveyor-General; Mr. Lewis, Secretary; Mr. Grey, and other members of the Board of Trade who were present. The experiments commenced at six o'clock, when a number of the floating lights, attached to lines, were cast into the river from the pier. On floating to the surface, the phosphoric substance of which they are composed suddenly burst into a blaze of light, and was only extinguished by being dragged under the water. The apparatus intended for the telegraphic light resembles a moderator table-lamp. This was placed on the jetty near the water's edge, and was operated upon by the inventor. In spite of the opaque fog, which completely enshrouded the river from bank to bank, the strong glare of the phosphoric light penetrated for some considerable distance, and was gratefully acknowledged by several boatmen, who would otherwise have had great difficulty in making the pier. Similar experiments were entered into a few days ago in the presence of Admiral Gordon and the Brethern of Trinity House, together with the officers of the exploring ship Fox. It was then pronounced that the invention was extremely suitable for all the purposes above named, but they could not recommend the apparatus as applicable for lighthouses. In consequence of the deep obscurity in which the river was last night involved, and the difficulty of thoroughly carrying out the experiments, it was arranged, at the request of Admiral Hardy, that a second course of experiments shall take place at Blackwall on some future occasion.—*Times.*

STEAM SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Mr. Cheverton, I believe, admits the applicability of the formula based on the midship section (A); it therefore appears to me that he cannot object to my making use of this same formula expressed in terms of the displacement ($D^{\frac{2}{3}}$) unless he is prepared to question the geometrical fact that the corresponding sectional areas of similar bodies vary as the square of the cube root of the cubical contents, that is, when applied to shipping the midship sectional areas of the immersed bodies vary as the square of the cube root of the displacements. As many of your readers are now taking an interest in the theoretical performances of large ships in the reasonable hope that the Great Eastern will afford the opportunity of practically testing the value of such theoretical calculations, and as the essay (Steam Ship Capability, 2nd edition) to which I made reference in my letter of the 1st instant, being now out of print, is not readily accessible, and as the promotion of public discussion, with a view to public utility, is the only object that I have in publication, you would do me a favour, and perhaps some of your correspondents an acceptable service, by inserting in the MECHANICS' MAGAZINE that portion of my essay which relates to the superior capabilities of large as compared with smaller vessels; and I take the liberty of enclosing a copy of this paper in the hope that you will publish it in the MECHANICS' MAGAZINE at your earliest convenience. As to Mr. Cheverton having understood that I am not the original discoverer of the formula referred to, I presume that he got that information from my own writings.

I am, Gentlemen, yours very obediently,

CHARLES ATHERTON.

Woolwich Dockyard, 14th November, 1859.

SHIPS' CHAIN CABLES.

M——T——, Nov. 10, 1859.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Your correspondent "Amicus," in connection with the destruction of the Royal Charter, has done much good, by enlightening the public upon the character of the iron plates used in the construction of iron vessels. There is one point, however, upon which his exposition is imperfect. I refer to the quality of the iron used in the *chain cables*, and I pray a short space for a few lines on that subject.

The first misfortune that we read of in this sad relation of the destruction of the Royal Charter is that after the anchors were cast the two *cables snapped*. The readers of the graphic article in the *Times*, "The Great Eastern in the gale," will not require to have their memories refreshed how the cables did duty in her case. We read—"In this last struggle some of the links of the chain cable were actually dragged out one-third longer, and one, which passed under the sharp bows of the vessel, was bent nearly double."

It is the writer's opinion had the Royal Charter cables been of the same quality as those of the Great Eastern that vessel and her cargo of precious metal and more precious lives would not have been lost. I have heard it stated and repeated that the proprietors of large vessels care not anything further about the quality of their cables, than that they stand the test required by the insurance offices. A very common or inferior iron cable will stand that test, when new. Yet such a strain may be received then, although the cable may not have snapped, that it would have been far safer to have used the cable without testing it. But with a superior quality of tenacious fibrous iron, no injury whatever is done to the cable by the test employed, and it would not be torn asunder without almost double the weight employed. I have spoken myself to cable manufacturers upon the impropriety of using common No. 2 bolts for making cables, and have received some such answer as that they received no complaints, and used the iron of the best makers. Is there no one to complain for the host of lives, as valuable as our own, which have been lost in the last fortnight's storms from this cause? I know nothing of the cables of the Royal Charter, but cannot help forming an unfavourable opinion of them, and suppose them to be no better than the plates employed.

The cables of the Great Eastern, as has been stated, were made by Messrs. Brown, Lenox, and Co., Cardiff, and of iron prepard for them at the works of Mr. Anthony Hill (Hill P F Co.); and the late Mr. Brunel had most emphatically requested Mr. Hill, that the best possible iron only should be provided,—and probably better iron was never seen than that used in the cables of the Great Eastern, and it was not a bit too good, as the proof as shown.

Allow me to close this subject in your own words. "This state of things should be remedied. In the name of Christian charity, let us not expose our fellow-creatures to violent deaths, 500 at a time, for the mere difference in the price per ton between good and bad iron." "VERITAS."

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I feel assured you will pardon me for bringing the attention of the public through your columns to the apparent ultimate cause of the loss of the noble steamer the Royal Charter

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with 100 lives, viz., the breaking of the chain cables. Why did not the Great Eastern go ashore from the same cause? a ship for which there was no parallel to decide upon an adequate size of cable in comparison with any other ship afloat. Surely shipowners should not be allowed to fix the size of cables and anchors for their ships—a subject which nine out of ten know nothing whatever about—grinding the captain down to a 16th inch in size, and urging the saving of a £5 note in the equipment of a noble ship. They should be compelled to take the best, and nothing but the very best, cables and anchors that can be made, and then the manufacturer would live by his own merit, and not by grinding down the wages of his unfortunate men. The very price they are now sold at is a sufficient guarantee that the articles must be rubbish. Where is England's maritime superiority? or where the feeling of a nation proud of its honourable dealings, while such wholesale slaughter is allowed for the saving of a few pounds in the outfit of her finest passenger ships? Owners assert that steamers do not require such good cables and anchors as sailing ships; surely this sad affair will open the eyes of the public. How is it that both screw and paddle, as exemplified in the *Times* account of the Great Eastern, are rendered useless by *debris*? mostly occasioned by the very means adopted to save the ship and lives, viz., the cutting away the masts, when nothing is left in the very jaws of death but the quality of the ship's cables and anchors.

A CONSTANT READER.

NOTICES.

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Our Weekly Gossip.

A REMARKABLE circumstance occurred on Wednesday in Portsmouth harbour:—It was H.M. ship Vulcan exercising, reefing and unreefing her topsails on the Cunningham system. It would have made the old tars of Benbow's time, or of a more recent age, stare to see the canvas disappearing as if by magic, and the area of the topsails, as it were, melting away without the appearance of any effecting cause; as at a distance the rotation of the yards could not be discovered. The Vulcan's exercise caused considerable interest in the harbour, and may be looked upon as an event in the Royal Navy. It was remarked by those who were on board that the senior-lieutenant, Lieutenant P. W. Stephens, had quite fallen into the new system as if he had known no other; and that although he had, as it were, to invent the routine of orders to be given as he entered into the exercise, there was no hesitation, but each order came out decidedly and distinctly. It is pleasant to see young officers of the service thus grappling so zealously and ardently with the improvements of the age, and it shows that although there may be some rust to rub off, we have some good solid material underneath to work upon. It has been before noticed that Commander Strach applied for the Cunningham system, and is entering into the change most earnestly and zealously. It will be by enterprising officers of this description that progressive improvement in the Navy will be effected.

The British Government (says *the New York Courier and Enquirer*), is drawing largely on the white oak forests of Virginia. Over three hundred men are now employed in getting timber in the mountains near Rowlesburg, on the Cheat River, which is to be used for gun carriages. The contractor has orders which it will take two years to fill. The Cheat River oak is said to be the best yet imported into England, and far surpassing the Canada oak, which it is fast superseding.

The Royal Engineers who are about to proceed to China will take out with them a large supply of all kinds of engineering stores and implements to be used in sapping and mining and siege operations. The detachment is also accompanied by a party of photographers, provided with the best instruments used in photography, for taking views of the defences, earthworks, &c. Several of the Royal Engineers have also been instructed in laying down and working the electric telegraph, several miles of wire being taken out by the expedition. All the men have been supplied with clothing suitable to the climate of China at the expense of the Government.

A practical movement for the protection of all animals of draught from the inclemencies of the weather is on foot amongst a few wealthy and influential persons, who have already subscribed somewhat largely to this end. The movement more particularly applies to the cab-horses of the principal cities of Great Britain, which may be seen standing by night and day, mayhap for hours, with their loins—the most susceptible portion of the animal—exposed. The consequences are, that when the poor beasts have to be thawed into movement, the gutta-percha thong is applied with undue severity, the horses suffer frightfully, and "Cabby" gets fined for cruelty. The simple method by which it is intended to obviate this state of things is either to dispense gratuitously, or to sell at a nominal price, a proper covering for this portion of the animal's body, and arrangements have been entered into for this purpose with some well-known Government contractors, to provide a waterproof covering made of a cheap and recently patented material with this view. We cannot, however, refrain from expressing our fear that although the motives of the benevolent persons referred to are highly commendable, the scheme is liable, if indeed practicable, to great abuse, inasmuch as those for whom its benefits were never intended may find means of profiting by the dispersion of a useful article to be had for little or nothing. And that the Legislature will interfere to make it a compulsory act upon the part of the cab-masters, and others, to provide their horses with such a protection is almost too much to expect. There is certainly a good deal that is suggestive in the scheme, and it appears to us that "The Society for the Prevention of Cruelty to Animals" would do well were it to endeavour to merge these actively benevolent persons, and whatever portion of their plan may be found feasible, into their already valuable sphere of usefulness. The costermonger's donkey, the laundress's pony, &c., are to be admitted to the full benefits of this seasonable thoughtfulness.

Messrs. Versmann and Oppenheim desire us to put the following note on record:—

Chemical Laboratory, 7 Bury-court, St. Mary Axe, London, Nov. 12, 1859.

GENTLEMEN,—Will you allow us to add a remark to a notice on our researches on the salts best adapted for rendering fabrics non-inflammable contained in to-day's number of your valuable paper. The phosphate of ammonia is *not* to be recommended to muslin-manufacturers, on account of its high price, whereas the sulphate of ammonia has the advantage of being infinitely cheaper, while it is equally harmless and required in a smaller proportion. We therefore advocated the application of the latter only in manufactories, and of tungstate of soda in laundries, in a communication read before the British Association for the Advancement of Science, which has just now been published separately by Messrs. Trübner and Co., and which gives a detailed account of our investigation. We beg to send you a copy of this pamphlet, and we are, Gentlemen,

Your obedient servants,

F. VERSMANN, F.C.S.
A. OPPENHEIM, A.C.S.

The following communication will find its fittest place here.—

Woolwich Dockyard, 14th Nov., 1859.

GENTLEMEN,—The adverse tone of the commencement of your editorial critique in the MECHANICS' MAGAZINE of the 4th inst. on my suggestion of "Unsinkable ships," enhances the importance of the conclusion at which you have arrived in your editorial on this subject of the 11th instant, namely:

"Mr. Atherton's fundamental idea may be a good one; indeed, we have ourselves a presentiment that unsinkable war ships, at least for purposes of home defence, will one day be devised. Good may arise from the introduction of the subject to public attention. If the Council of the Society of Arts can adopt any means of hastening the realisation of Mr. Atherton's ideas, they too will earn the approbation of the public."

The subject being thus recommended for the consideration of the Society of Arts, it may be premature to anticipate their decision. I would merely observe how effectively the invitations of the Society of Arts have, on many occasions, been responded to whenever through the action of that Society, the public mind has been directed to any public requirement. For example: within a week of the publication in the Society of Arts' *Journal* of the 28th ult. of my suggestion on "Unsinkable ships," I received communications from parties already prepared to take up the subject of the required material therein referred to; and it was a singular coincidence that in the very same journal an article appeared describing (with reference to a totally different subject) a new process for converting a certain solid substance into a cellular mass; and in the MECHANICS' MAGAZINE of the present week, we have the subject of rendering even textile materials uninflammable practically treated of. Both these points are analogous to what is required in the present case.

I cannot doubt that if the Council of the Society of Arts should take up this subject, and be liberally supplied with the means of offering the premiums referred to, namely, first: For the material best adapted for the construction of unsinkable ships or rendering ships unsinkable; and, second, plans for the most effective application of such material for all cases of naval construction, I have no doubt that such action of the Society of Arts would call forth a display of chemical, mercantile, and constructive knowledge of no ordinary character, and, may be, of the greatest public utility.

I am, Gentlemen, your very obedient servant,

CHARLES ATHELTON.

A reliable gentleman favours us with the following statement of a very curious incident:—"The following extraordinary occurrence took place during the late severe gale at Ystrad Mynach, the seat of a friend of mine in Glamorganshire: an oak tree computed to be about 3½ tons weight, was blown fairly up by the roots and prostrated in the direction of the wind; the wind changed directly round and blew with increased violence, when the oak tree was lifted perpendicularly, and turned over in exactly the opposite direction to that in which it first fell. This fact was witnessed by one of the men, who was so alarmed that he ran from it as fast as he could."

An inquirer sends the following:—"Mr. St. Croix, in page 298, first column, of your last number, speaks of the screw fans being at an angle of 45° with the shaft. At the bottom of page 299, first column, he speaks of the fans being 45° degrees with each other. Is there not some mistake? If the fans are at 45° with the shaft (or axis) they must be at 90° with each other."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 885, 888, 895, 937.

BOILERS AND THEIR FURNACES, &c., 895, 932.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 890, 923, 931, 938, 939, 940.

SHIPS AND BOATS, including their fittings, 904, 907, 919.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 913, 926.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 892, 900, 917, 934, 935.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 880, 887, 899, 905, 909, 916, 922, 936.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 908, 918.

LIGHTING, HEATING, AND VENTILATING, 897, 906, 911, 914, 925.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 893, 896, 919, 928.

METALS, including apparatus for their manufacture, 883, 915.

CHEMISTRY AND PHOTOGRAPHY, 879, 891.

ELECTRICAL APPARATUS, 881.

WARFARE, 884.

LETTER PRESS PRINTING &c, 889.

MISCELLANEOUS, 878, 882, 886, 894, 898, 901, 902, 903, 912, 920, 921, 924, 927, 929, 930, 933, 941.

878. M. A. F. MENNONS. "An improved articulated joint for water, gas, and steam pipes." Dated April 8, 1859.

This invention is not described apart from the drawings. *Patent completed.*

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879. M. A. F. MENNONS. "Improvements in the treatment of mineral phosphates of lime." (A communication.) Dated April 8, 1859.

The patentee claims the treatment of natural or fossil phosphates of lime by ammoniacal precipitation from their solution in hydrochloric acid for the production of a chemically pure and thoroughly soluble and assimilable phosphate of lime for agricultural purposes. *Patent completed.*

880. N. A. GRUMEL. "Improvements in dyeing cotton, wool, silk, flax, and other fibrous materials or fabrics." Dated April 8, 1859.

This relates to means of obtaining a fast black dye, and the shades thereof, without the use of indigo. *Patent completed.*

881. W. HOOPER. "Improvements in insulating and protecting telegraphic conductors." Dated April 8, 1859.

The patentee first coats the conductors with india-rubber, and afterwards applies over the first coat another coat consisting of india-rubber combined with sulphur. These two coats are separated the one from the other by a layer of a material which will prevent the action of the sulphur of the outer coating on the inner coating when the heat necessary to change the outer is applied. In order thus to separate the two coats the patentee employs a layer of thin metal. The second part of the invention consists in the production of a vulcanized or converted india-rubber coating on wire or other metal conductors which are coated with gutta-percha whether applied directly to the metal conductors or on to conductors which have previously been coated with tin or other protecting metal. *Patent completed.*

882. W. HOOPER. "Improvements in re-working or re-manufacturing compounds of india-rubber and sulphur." Dated April 8, 1859.

This consists in combining raw india-rubber and sulphur with the ground product of waste or old converted sulphur compounds of india-rubber, and subjecting the same to high degrees of heat to convert or change the same into elastic and hard compounds. *Patent completed.*

883. W. HENDERSON. "Improvements in treating certain ores and in obtaining products therefrom." Dated April 8, 1859.

This relates, 1, to the treatment of zinc ores, or other ores containing zinc. 2. To the treatment of ores of antimony that contain lead and other metals. 3. To the treatment of copper ores. 4. To the treatment of ores or products containing cobalt. 5. To the treatment of gold and silver ores and auriferous quarts. We cannot possibly give space to the voluminous details of this invention. *Patent completed.*

884. W. E. NEWTON. "Improvements in telegraphing and in telegraphic apparatus." (A communication.) Dated April 8, 1859.

This consists in an arrangement of telegraphic apparatus that shall not be susceptible to the changes of the weather, and that shall generate an amount of inductive electricity that shall answer all demands. The invention is not described apart from the drawings. *Patent completed.*

885. E. R. HANDCOCK. "Improvements in steam and other motive power engines." Dated April 8, 1859.

This consists in the use of an additional crank loose on the axle, and placed at such an angle as will give sufficient leverage to put the shaft in motion at the first starting of the engine, and to force or aid the crank over the dead points. In some cases the patentee uses a single bolt inserted into a piece of metal which is firmly fixed to the shaft, so that the bolt may be acted on by means of a cradle or other convenient arrangement; when reverse action is required two bolts suitably fixed are used. *Patent completed.*

886. T. SPENCER. "Improvements in the economical treatment of refuse or wash matter containing sulphur." Dated April 9, 1859.

The patentee claims the use of the oxides, ores, and other compounds of iron and the oxides of manganese for the obtainment of sulphur from the hitherto refuse or waste matters. *Patent completed.*

887. E. J. HUGHES. "Improvements in the manufacture of woven fabrics." (A communication.) Dated April 9, 1859.

Here the warp and welt threads are arranged so as to obtain an improved mode of threading or tramping. The improved method of making the fabric dispenses with the use of temples, and weaves with much less strain upon the cloth, thus requiring less weight on the yarn beam, and allowing the loom to be worked at a greater speed. *Patent abandoned.*

888. T. BARNETT, H. T. SOURBUTS, and W. LOYND. "Improvements in steam-engines." Dated April 9, 1859.

This consists in a method of supplying the feed-water to steam-boilers at a higher temperture than has hitherto been obtained. *Patent completed.*

889. J. H. YOUNG. "Improvements in setting-up (composing) and distributing types." Dated April 9, 1859.

Under that part of the composing machine at which the types issue to be collected into a line the patentee places a propeller to propel the types as they stand in the receiver, and over this propeller he causes the types to tilt so that the head of the type issuing from the composing machine, and about to fall into the receiver, shall be raised so as to prevent the tail of the type immediately following from passing over it. With reference to distributing types, when a reservoir is used to hold types of uniform thickness, the aperture which regulates their exit may be of a determinate size, but when the reservoir is intended for all the sizes of a fount the patentee has found the following arrangement useful:—In front of the exit aperture he places three or four thin blades of metal each provided with a spring and connected by a catch-bar, with the pusher that sends the types out of the reservoir. The pusher is made as thin as the thinnest type used, and so are the blades in front of the exit aperture. The patentee next describes the mode of operation, which we cannot quote here. *Patent completed.*

890. J. HAWKINS. "Certain improvements in the manufacture of stirrups, bits, spurs, buckles, and other such like articles connected with harness and saddlery." Dated April 9, 1859.

This invention is not described apart from the drawings. *Patent completed.*

891. J. H. JOHNSON. "Improvements in the manufacture or production of the ferrocyanide and cyanide of potassium." (A communication.) Dated April 9, 1859.

For the manufacture of prussiate of potash it is proposed to melt the carbonate of potash in a cast iron vessel with water, and then to add thereto a sufficient quantity of wood, charcoal, or coke, to completely imbibe the solution of carbonate of potash. The whole is now heated until the charcoal or coke becomes thoroughly dry. The carbonate of potash will then be found distributed in the porous and spongy mass. This mass, with the addition of five parts by weight of iron filings, is introduced into two retorts communicating with each other by a pipe which connects the upper part of one retort with the lower part of the other. The retorts are now heated to reduce the carbonate of potash to the state of peroxide of potassium, whereupon by the introduction into the retorts of a current of ammonaical gas whilst the retorts are at a white heat, the yellow prussiate of potash will be obtained. The gas enters the bottom of the first retort containing the charcoal, and acting on the potash cements it into prussiate of potash. On leaving the first retort the gas enters the bottom of the second retort, and finally escapes by a pipe or chimney. The manufacture of the cyanide of potassium is accomplished in a precisely similar manner, with the exception that the iron fittings are dispensed with. *Patent completed.*

892. R. J. DERHAM. "Improvements in cheese-vats." Dated April 9, 1859.

This consists in forming a vat of staves with galvanized or not galvanized spring hoops, so that the hoops may open the staves, and thereby easily disengage the cheese from the vat. *Patent abandoned.*

893. J. MARTIN. "Improvements in the materials used in the manufacture of bonnet-fronts and ruches." Dated April 9, 1859.

This consists in the application of a band of cotton or linen tape to the back part or folded edge of bonnet fronts and ruches. It also consists in introducing a strip of pasteboard, &c., instead of wire within the band. *Patent completed.*

894. C. F. VASSEROT. "A new motive power applicable to tanneries." (A communication.) Dated April 9, 1859.

This consists in a horse mill the power of which is employed to put in motion by means of bands and pulleys a certain number of cylinders mounted upon shafts and turning upon pivots. *Patent abandoned.*

895. W. E. NEWTON. "Improvements in steam-engines and boilers." (A communication.) Dated April 9, 1859.

This relates, 1, to a novel mode of communicating the motion of the piston or pistons of the engine to the crank shaft. 2. To the condensation of the steam after it has acted on the piston or pistons. 3. To the mode of supplying or distributing it to or in the cylinders, and of conducting it therefrom to the condenser. 4. To the production or generation of steam in boilers with a moveable furnace or fire-place of an annular form. The invention is not described apart from the drawings. *Patent completed.*

896. H. F. GARDNER. "Improvements in machinery for blocking or crimping the uppers of boots and shoes, and in treeing boots." (Partly a communication.) Dated April 9, 1859.

This includes a variety of detail in connection with blocking, crimping, and treeing to which we cannot devote space. *Patent completed.*

897. R. BROWN. "Improvements in stoves and apparatus for warming and ventilating apartments and buildings." Dated April 9, 1859.

This stove is made of metal or earthenware, or both combined, and burns either gas or ordinary fuel. It is constructed so as to admit into an apartment fresh air from the external atmosphere, and to warm it by contact with certain heating surfaces (which we cannot more particularly allude to) and to pass it warmed into the apartment or building to be warmed or ventilated. *Patent abandoned.*

898. B. BAUGH. "Certain improved arrangements for working fly presses by steam, water, or other power." Dated April 11, 1859.

This consists in producing a continuous elevating and descending action of the press by means of certain combined arrangements which we cannot here allude to in detail. *Patent abandoned.*

899. R. WAPPENSTEIN. "Improvements in cop tubes, and in machinery or apparatus for placing the same on the spindles used for spinning and doubling fibrous materials." Dated April 11, 1859.

The patentee makes the tubes of white metal, and casts them in moulds having grooves or other patterns so that the tubes shall be grooved, screwed, or indented on their exteriors to prevent their slipping in or out of the cop after it is built. He places any convenient number of the tubes on the spindles at one and the same operation by placing them in a clipper formed of two pieces of wood, metal, or other material so as to hold all the tubes or a division of them until they are required to be lowered on the spindles. *Patent completed.*

900. W. SCHOFIELD. "An improved effervescing lemonade." Dated April 11, 1859.

This lemonade is composed by mixing together the following ingredients:—Rich Malaga wine ½ pint, essence of lemon, 30 drachms, sugar, 8 lbs., acid of lemon, 3 oz., water, 3 quarts and ½ pint to a gallon of liquor, to which is added the aërated water. *Patent abandoned.*

901. J. ANDERSON. "Improvements in the construction of the furnaces of bakers' ovens for the purpose of consuming smoke, which improvements are also applicable to the consumption of smoke in other furnaces." Dated April 11, 1859.

Here the inventor provides an additional flue which is carried into the main flue in the oven. In the additional flue he inserts a damper for regulating the supply of air to the main flue. The air flue thus terminating in the chimney, the boiler or oven receives the full benefit of the flames without the temperature by the direct introduction of cold air. Dampers are provided in the furnace to regulate the strength of the draught. *Patent abandoned.*

902. W. BOALER. "Certain improvements in the manufacture of soap." (Partly a communication.) Dated April 11, 1859.

This consists, 1, in mixing steatite with silicate of soda and introducing it into any and every description of soap. 2. In mixing steatite with the ordinary soda of commerce, and employing them during the process of the manufacture of soap. 3. In the use of either of these two articles in combination with steatite in the manufacture of soap. *Patent abandoned.*

903. L. WIMMER. "An improved preparation for killing beetles." Dated April 11, 1859.

This consists of a mixture of alumina containing various dissolved or oxidised metals and earth, farina of peas, borax and sugar in suitable proportions. *Patent abandoned.*

904. A. BOWERS. "Improvements in or applicable to keels of navigable vessels." Dated April 11, 1859.

Here moveable pieces are attached to the bottom of the ordinary keel by a hinged joint, so that it may be set at any angle required by mechanical means which can be acted upon from the interior or deck of the vessel. *Patent abandoned.*

905. W. ROWAN. "Improvements in spinning flax, hemp, and other fibrous materials." Dated April 11, 1859.

This relates to machinery to be used in preparing flax, hemp, China grass, and other similar fibres in order to fit them for being spun into yarn. In lieu of the screws now used in screw gills the patentee uses screws the pitch of which is variable, so as to produce a corresponding variable motion in the gills instead of a uniform motion, whereby the drawing action on the fibres is more effectually performed than in the machines now in use. *Patent completed.*

906. R. A. BROOMAN. "Improvements in candle-

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moulds." (A communication). Dated April 11, 1859.

This consists in fitting to moveable nozzles used in candle-moulds a spring or springs, whereby the nozzle may be pressed down to drive the finished candle from the mould, after which the nozzle will return to its original position by the pressure of the spring or by the wick needle, in which position it will be retained by the spring or springs. *Patent completed.*

907. W. S. CLARK. "Improved means of loading ships or vessels with coal, and of separating or removing small coal therefrom." Dated April 11, 1859.

The patentee claims loading ships with coal by means of boxes or tubs into which the coal is delivered from the shute, and by which it is lowered through the hatchways into the hold. He also claims forming the shute with screens through which the small coal will pass, and falling into lower shutes will be conducted back to the quay or discharged into any suitable receptacle instead of being allowed to pass into the ship. *Patent completed.*

908. W. H. BARLOW. "Improvements in beams and girders." Dated April 11, 1859.

This relates to beams and girders which have one or more intermediate supports, in addition to the two terminal bearings, and the invention consists in constructing beams or girders with an increased depth of beam or girder over or near the piers or intermediate points of support, by which the patentee not only obtains greater strength over the piers or intermediate points of support with the same quantity of material in the flanges, but the radius of curvature of the upward flexure is rendered greater, that is to say, the curve is flatter and the points of contrary flexure are thereby moved nearer to the centre of the span, so that the sectional area of metal in the flanges, throughout the centre portion of the beam between the points of contrary flexure, may be considerably reduced, without diminishing the strength of the beam when compared with a beam of equal section. *Patent completed.*

909. J. MARLAND. "An improvement in the manufacture of cop tubes." Dated April 11, 1859.

This consists in applying gutta-percha, glue, or other cement over the whole surface of the paper or material, into the desired angular forms for making cop tubes; and after the paper or material has been cut into proper forms, and allowing it to set or dry before cutting the paper or material, in applying a fluid solvent, or heat, or both to render the cement adhesive as the material is wound round a suitable spindle or mandril. *Patent completed.*

910. W. CLARK. "An improved safety block to be used for lowering ships' boats, the same being applicable to other like analogous purposes." Dated April 12, 1859.

The block with its sheave or sheaves is constructed in the ordinary manner, but has attached and secured to the bottom or lower part thereof a hook, which the patentee calls a tumbling hook. *Patent completed.*

911. D. DOIG. "Improvements in the construction of gas lamps." (A communication.) Dated April 12, 1859.

This consists, 1, in the use or application of glass prisms or triangular or nearly triangular pieces of glass placed horizontally or nearly so in or on to the upper part of steel or other glass lamps. 2. In the substitution of glass that is combined with metal for, and instead of, the ordinary tin or other opaque framing steel gas lamps. *Patent completed.*

912. P. AITCHISON. "Improvements in taps." Dated April 12, 1859.

Here the patentee forms the valve of leather encased in brass, and constructs the valve seat with a projecting rein concentric with the circumference of the orifice therein. The valve is attached to the key, spindle, or plug, which works in a screw collar and closes the valve upon the projecting seat, or removes it therefrom, according to the motion imparted to it. The pressure of the water (which ordinarily causes vibration of the valve when open, and intermittent action) is regulated where the supply pipe is attached by the diameter of the inlet orifice of the tap. *Patent completed.*

913. G. J. JOHNSTON. "Improvements in drills, for drilling of corn, seeds, and manure." Dated April 12, 1859.

Here the drill coulter has a rotary motion working on its own axis; it is self-acting, and self-cleansing for cutting of the earth, and for depositing corn seeds and manure, and can be so fixed as to penetrate the ground to any depth that may be required, and can be applied to any drill now extant. *Patent abandoned.*

914. E. T. NOUALHIER. "An improved ventilator." Dated April 12, 1859.

This consists of a cylinder to the upper part of which a tube for the entrance of air is soldered so as to communicate with the interior. To one end of the cylinder a pipe is adjusted which passes through, and extends a short distance beyond, its opposite end, to which opposite end of the cylinder is soldered another tube of larger diameter than the first (with which it forms one whole), so as to leave a small space between it and the first tube for the egress of air from the cylinder. Thus the air entering the top pipe passes into the cylinder, and afterwards into the large and smaller tubes, forming thereby a double current of air. *Patent abandoned.*

915. W. E. NEWTON. "Improvements in the manufacture of iron." (A communication.) Dated April 12, 1859.

This chiefly consists in the combination of the blast chamber and pipe with what is called the dust plate, and also in delivering a blast of air into the liquid iron in the hearth of the blast furnace by a trigger or blow pipe introduced into the front part of the hearth between the dam and the tymp, the said trigger or blow pipe being pushed down at an angle of about 90 degrees into the blast chamber through the dust plate, clay, crust, and the fluid cinder down to near the bottom of the liquid iron in the hearth. *Patent abandoned.*

916. P. HILL and J. MOORE. "Improvements in weaving double pile fabrics." Dated April 12, 1859.

Here six warp beams or rollers are employed, and eight beams of heddles. Two of the six rollers or beams have the ground warps wound thereon, and the pile warps are wound on to the other four beams or rollers. The ground warps are passed through and actuated by four leaves of heddles, and the pile warps are passed through and actuated by four leaves of heddles. The batten or slay is caused to beat up twice for each weft, and the shed in the warps is changed between the two beats. An extra leaf of heddles is used to divide the warps to keep the warps clean. This extra leaf of heddles remains stationary during the process of weaving, no eyes being used therein, but only single head threads, between which the warp threads move up and down thus clearing themselves. The cleared leaf of heddles is set at the back of the other leaves of heddles. *Patent completed.*

917. C. BURRELL. "Improvements in apparatus for screening corn and seeds." Dated April 12, 1859.

Here a screen is suspended on four rods which at their lower ends are pin-jointed to the screen, and at their upper ends are pin-jointed to the ceiling, so as to admit of the screen swinging to and fro when actuated by a crank and connecting rod, or by other means. Two of the suspending rods are longer than the other two in order that the screen may assume an inclined position. Below the screen a series of rods are fixed, which are arranged in pairs, and each pair has a series of scrapers or blades strung on it, there being as many scrapers or blades on each pair of rods as there are spaces between the longitudinal wires of the screen, and there are as many pairs of rods as there are divisions formed by the transverse wires in the length of the screen. The scrapers or blades are kept separate by washers placed between them, which are also strung on the lower of each pair of the fixed rods. *Patent abandoned.*

918. M. CASTAY. "Improvements in metallic bridges." Dated April 12, 1859.

This relates to a new system of cast and wrought iron bridges formed of parts jointed together. The invention is not described apart from the drawings. *Patent completed.*

919. J. CROSSDALE. "Certain improvements in boots and shoes. Dated April 12, 1859.

This consists mainly in enterposing perforated tubes of elastic material between the insole and outer sole of boots and shoes, the said tubes being connected with the external atmosphere by openings formed in the upper, sufficiently above the sole of the boot and shoe to prevent the entrance of wet and dirt. It is proposed to insert eyelets into the several perforations in the aforesaid tubes, and to connect such perforations to or with other perforations made through the insole of the boot or shoe. *Patent completed.*

920. J. WARD. "An improvement or improvements in working fly presses used for raising metals, coining, and other like purposes." Dated April 12, 1859.

The inventor applies a steam cylinder to the top of the screw of the press, the piston of the steam cylinder passing through both the bottom and top of the cylinder. The lower end of the piston rod is coupled to the top of the screw by a coupling which permits the screw to rotate without the rotation of the piston rod. The upper end of the piston rod acts upon the slide valve of the cylinder so as to admit steam under the piston when the screw is rising, and to admit steam above the piston when the screw is descending. *Patent abandoned.*

921. R. A. BROOMAN. "Improvements in the preparation of red dyes." (A communication.) Dated April 12, 1859.

These new dyes, called by the inventor "Fuschiacine," are prepared by heating together to the point of ebulition a mixture of aniline and of anhydrous bi-chloride of tin. *Patent completed.*

922. S. TATTON. "Improvements in preparing and treating silk, and improvements in dyeing silk." Dated April 12, 1859.

This consists, 1, in preparing raw silk, silk thread, sewing silk and silk twist, (commonly called barber's sewings or boot twist) before or after being dyed any colour except black, and whether manufactured into thread or twist or not, by submitting the silk to a bath of sugar, or of sugar and gum, or to a bath of any other suitable glutinous substance. 2. In dyeing raw silk, silk thread, sewing silk, and silk twist yellow and gold colours, and all shades thereof, by submitting the silk first to a bath containing anatto and soap; second, to a bath containing muriate of tin, or other solutions of tin or salts of tin; third, to a bath containing Persian or Turkey berries. *Patent completed.*

923. R. EMBRY. "Certain improvements in carriages for common roads." Dated April 13, 1859.

This invention is not described apart from the drawing. *Patent completed.*

924. W. A. MARTIN and J. PURDIE. "Improvements in fire-bars." Dated April 13, 1859.

The sealing of this patent is opposed, and the papers relating thereto cannot be seen.

925. H. ECKHORN. "Improving and regulating the production of light in lamps, to which he gives the name of "Universal Lamp Regulator." Dated April 13, 1859.

This lamp regulator is formed by a moveable cylinder which is introduced into the lower part of another moveable concentric cylinder, which latter is closed at the top. This regulator may be contracted or enlarged, raised or lowered, so that the admission of air to the lamp is under perfect control. *Patent abandoned.*

926. R. COLEMAN. "Improvements in agricultural implements." Dated April 13, 1859

This relates to two previous patents of the patentee, which embody various improvements in implements known as cultivators, and consisting of a number of tines, hoes, ploughs, &c., mounted on fulcra, and all having communication with a barrel spindle, by motion from which they are inserted or removed from the soil, and the depth of the insertion regulated. According to the present invention, the patentee furnishes implements of this class with a double set of tines, scarifiers, hoes, &c., to act in opposite directions to each other, so that there is no necessity to turn round at the headlands. To move machines of this class a sufficient breadth sideways, he mounts all the carrying wheels on swivel supports, and so arranges and connects them that they may be all moved on their axes simultaneously by hand gear in connection therewith. Another part of the invention relates to such agricultural implements as are mounted on wheels, and turn round at the headlands, or otherwise to act and traverse in the opposite direction. To facilitate the turning, he mounts a cross rod between the hind wheels, and connects with it a hand lever, by which the attendant moves the cross rod so as to lock either one of those wheels according to the direction in which it is desired to turn. *Patent completed.*

927. J. APPERLY and W. CLISSOLD. "An improved construction of fulling machine." Dated April 13, 1859.

This relates to the rollers of fulling mills, the object being to perform the fulling with little friction. The inventors use but one pair of fulling rollers, mounted horizontally in the fulling mill, and drive them in the usual way. The endless band of cloth to be milled is passed over guide rollers, and between a pair of driven nipping rollers, which are situate immediately above the fulling rollers. These rollers draw the cloth forward, and allow it to drop into the bite of the fulling rollers, by which it is fulled or milled while in a slack state. To facilitate the traverse of the cloth over the bottom of the mill-case, they employ a reciprocating pusher, which being placed below the fulling rollers, will drive against the cloth as it falls from the fulling rollers, and push it forward in folds to the other end of the mill-case, whence it is drawn up over the guide-rollers, as above explained. *Patent abandoned.*

928. W. CRAFT and T. WILSON. "Improvements in the manufacture of pinafores and bibs for children." Dated April 13, 1859.

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The patentees make bibs of a light water-proof material, and form the lower part with a trough or gutter of the same, so that any liquid coming in contact with the outer surface of the bib, will run down into the gutter. *Patent completed.*

929. A. R. JOHNSON. "An instrument for damping, severing, and affixing postage and other like stamps." Dated April 13, 1859.

The patentee claims the construction of an instrument for damping, severing, and affixing postage and other like stamps in which the motion for severing and stamping is made to act upon the feed-wheel or wheelr, and to advance a fresh stamp ready for the next operation. *Patent completed.*

930. J. A. COFFEY. "Improvements in apparatus for heating liquids." Dated April 13, 1859.

This consists in introducing surfaces heated by steam, superheated steam, hot liquid, or hot air into the interior of the vessel containing the fluid to be heated, for which the patentee places therein a suitable heating vessel filled with direct passages proceeding from the bottom to the top, and open both at top and bottom, but having spaces between such passages closed in. *Patent completed.*

931. W. A. GILBEE. "Improvements in the construction of the axles of railway and other carriages." (A communication.) Dated April 13, 1859.

The object here is to render the two wheels of the same axle able to turn independently of each other, and the invention consists in the use of a second hollow iron axle, serving as an envelope to the inner axle. One of the wheels is fixed on the hollow axle, and the other on the inner axle, the hollow axle being bored internally so as to permit the inner axle, which is turned in a lathe, to play within it freely. The hollow axle extends from the external part of the nave of the wheel fixed to it to the interior of the nave of the wheel adapted to the inner axle; its length may, however, be modified according to requirements. The inner axle supports the weight of the carriage. *Patent abandoned.*

932. J. L. STEVENS. "Improvements in fire-grates of locomotive, marine, and other furnaces." Dated April 13, 1859.

This invention was described and illustrated at page 284, No. 43, of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

933. J. HUGHES, W. WILLIAMS, and G. LEYSHON. "Improvements in the manufacture of tin and terne plates." Dated April 13, 1859.

Here in place of putting the plates after they have passed through the "wash-man's" pot into a pot of hot grease, the patentees place the plates in a rack contained in another pot of hot metal, and when the rack is full they raise it slowly out of the pot. While the plates are thus being raised out of the liquid metal, the superfluous metal runs off, and when the plates are cooled, which they are allowed to do in the rack, they are finished. *Patent completed.*

934. J. GILLETT. "An improved mill used for grinding, crushing, and reducing bones and other mineral and vegetable substances." Dated April 14, 1859.

This invention is not described apart from the drawings. *Patent completed.*

935. J. LUIS. "A new cooling apparatus for liquids, especially beer." (A communication.) Dated April 14, 1859.

This mainly consists in the use of an apparatus composed of a number of tubes through which cold water is caused to circulate, entering at the bottom, and ascending, and passing out heated at the top *Patent completed.*

936. T. BIRD. "Improvements in the application and use of a certain natural product or products in the manufacture of pickers for looms, drawing rollers for spinning machinery, cop tubes, and for steps and brushes generally where lubrication is required." Dated April 14, 1859.

The patentee uses the nuts known as the Coquilla nut (*Attalea purifora*) and the vegetable ivory nut (*Phytelephas macrocarpa*), which, from their oily nature, require no additional lubricating matter, and are applicable to the above purposes. For pickers for looms he puts a bush made of the said substance in the tube, bush, or barrel of the picker, which runs on the spindle, whether the said tube be made of buffalo hide, wave metal, or other material, and he makes the picker of a single T shape, the tube at the top forming the top part without any slot for the picking strap, the picking strap being fixed round the tube and the centre of the picker; the bush or barrel may also be bounded with caoutchouc, leather, buffalo hide, or other suitable substance. *Patent completed.*

937. H. C. COULTHARD and J. JORDAN. "Certain improvements in steam engines." Dated April 14, 1859.

This consists, 1, in introducing a second facing and also an upper portion of the valve which is to work or slide upon the said extra facing. The steam being admitted between the top and bottom portion of the valve, it exerts pressure upwards against the top, and relieves the bottom or steam tight surfaces from a great amount of pressure. 2. In a method of adjusting the valve to the facings by means of a screw and internal spring to render such adjustment slightly elastic; by means of which improvements the wear of the sliding surfaces is much diminished, and an easier and more smooth action of the eccentric is effected. *Patent abandoned.*

938. J. BEATTIE. "Improvements in the means of preventing locomotive engines and carriages in motion on railways leaving or running off the rails." Dated April 14, 1859.

Here a suitably formed ring of metal is cast on, or affixed in one or more pieces, to the inside of the boss of each wheel, with a lip or turned-down edge, and on the axle of each wheel there is a ring of metal with a lip or turned-up edge, so placed that such turned-up edge or lip will come between the turned-down edge and the boss of the wheel, so that if the axle break between such turned-up edge and the boss, the lips or edges will preserve it in a horizontal position or nearly so, and preserve the engine or carriages on the line of rail. For the same object the patentee has in some cases an additional or check rail parallel with the ordinary rails at convenient positions on inclines or curves and other suitable parts of the line of rails, and he fixes such check rail in a channel or groove in the chairs of the railway or in a suitably formed chair for the purpose, or by other means, and bolts such check rail to the ordinary chair rail or sleeper. *Patent completed.*

939. E. PARTRIDGE. "An improvement in the manufacture of 'pipe' boxes for cart and waggon axles." Dated April 14, 1859.

This consists in forming conical steel bearings in the ends of conical cast iron boxes by casting the iron on to two conical collars shaped and prepared to fit the axles to which the boxes are to be fitted. After the boxes are cast the patentee hardens them in water. The two collars take the entire bearing of the axle and the space left between them and the axle, when in the box, forms a grease chamber. *Patent completed.*

940. W. BARNES, S. PICKERING, and J. ROBERTS. "Improvements in retarding and stopping railway locomotives and trains." Dated April 14, 1859.

This consists in the application of an additional cylinder on one or both sides of the engine, the piston-rod or rods of which are connected by a rod to the same crank pins on the driving wheel or axle, or to the engine cranks. The piston rod of the second cylinder is fitted so as to slide through its piston, but has a stop on it with an elastic packing or buffer, which confines it to the rod, and prevents contact with the bottom end of the cylinder. This cylinder is placed in communication with the boiler by a steam pipe and cocks, or valves and connecting gear, so that while the steam is turned off from the engine it is admitted to this second cylinder between the cover and the piston. The steam so admitted produces an elastic obstruction to the further rotation of the driving wheels, or the wheels with which such cylinder may be placed in communication, and so retards and ultimately stops the train. Eduction pipes are also provided, the eduction being controlled by valves or cocks. *Patent abandoned.*

941. E. DOWLING. "Improvements in parts of scales or weighing machines, and in balance weights used for those articles, which are also applicable for other purposes." Dated April 14, 1859.

This comprises various improvements in scales and weights, and consists chiefly in the adaptation of glass to the manufacture of the same. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Aug. 17, 1859.

1894. A. V. Newton. Improvements in the construction of carriages, and in apparatus for guiding or reining in carriages horses. (A communication.)

Dated Aug. 24, 1859.

1932. G. Riley. Improvements on helical refrigerators for cooling brewers' and distillers' worts.

Dated Sept. 13, 1859.

2083. A. B. Seithen. Improvements in apparatus for shaping cork stoppers, and in the manufacture of life-buoys and buffers of cork.

Dated Sept. 20, 1859.

2144. L. Matthews. Improvements in machinery to be employed in introducing plain or coloured wire upon lace or other fabrics, for the purpose of ornamenting the same, or for running on and stiffening caps, cap-borders, or for other similar purposes.

Dated Oct. 4, 1859.

2250. T. Cook. Improved tools for making screws.

Dated Oct. 5, 1859.

2258. R. Fisher and C. Aspray. Improvements in photographic stereoscope slides, and in the stereoscopes employed in viewing the same.

Dated Oct. 10, 1859.

2298. J. Bentley and H. J. Sillem. Improvements in breech-loading fire-arms, and the machinery for manufacturing projectiles for small arms.

Dated Oct. 14, 1859.

2340. J. F. Conscience. A new and improved process of making bread, and certain machinery connected with it.

Dated Oct. 15, 1859.

2356. M. Henry. An apparatus for washing hanks skeins, threads, and yarns of silk and other fibrous materials. (A communication)

Dated Oct. 19, 1859.

2398. R. Hobson. Improvements in producing ornamental devices in glass or other transparent substances, for decorative or other purposes.

Dated Oct. 25, 1859.

2436. W. C. Day. Improvements in stockings and drawers, and other articles of under clothing.

2438. J. M. Napier. Improvements in printing machines.

2440. H. C. Hurry. Improved apparatus for applying or using magnetism or electro-magnetism as a motive power.

Dated Oct. 26, 1859.

2442. A. McGlashan. Improvements in refrigerators for cooling worts and other liquors.

2444. J. J. Bourcart. Improvements in mules for spinning.

2446. W. W. Kennedy. Improvements in shirts.

2448. J. W. Hackworth. Improvements in dynamic valve-gear, applicable to locomotive, marine, and other engines.

2450. J. Armour. Improvements in apparatus for measuring and for regulating supplies of solid and fluid substances in the preparation of mixtures or compounds.

2452. R. Christy, jun. Improvements in means or apparatus for securing the closing of doors.

Dated Oct. 27, 1859.

2454. I. Zacheroni. Improvements in electric telegraph cables for submarine and subterranean uses, and in submerging the same.

2456. P. D. Mickles. An automatic railroad switch. (A communication.)

2460. H. Phillips and J. Bannehr. Improvements in the manufacture of manure.

2462. R. A. Brooman. Improved threads for weaving, and a machine for making the same, which is also applicable to the winding or coating of one thread with another. (A communication.)

Dated Oct. 28, 1859.

2464. A. B. Mitchell. A new or improved pen-holder.

2465. J. Plantier. Improvements in brushes and brooms.

2467. D. Dillies. Innovations in weaving looms.

2469. J. F. Cole. Improvements in time-keepers.

2470. J. J. Baranowski. Improvements in railway signal apparatuses.

Dated Oct. 29, 1859.

2471. G. Ghesquière. A process to render gold and silver malleable and ductile.

2473. S. C. Lister. Improvements in dyeing silk, cotton, and china grass, and similar vegetable fibre, and in preparing and spinning coloured and mixed coloured yarns from such fibres.

2474. C. Stannet. Improvements in apparatus used in the manufacture of boots and shoes or other coverings for the feet.

2475. J. S. Margetson. Improvements in collars for gentlemen's, ladies' or children's wear.

Dated Oct. 31, 1859.

2477. J. A. Turner. Improvements in rendering paper waterproof.

2479. T. C. Newby and J. A. Rainé. Improvements in portable bedsteads and spring mattresses.

2480. J. Ingham and G. Collier. Improvements in the manufacture of fabric, of the character of that technically called "camlet," also in the winding of yarn employed in the production of such fabric, part of which improvements is applicable to other weavings.

2481. J. Bolton. Improvements in means or apparatus for winding thread or yarn on to shuttle

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bobbins, or pirns, which improvements are also applicable in winding on to other bobbins, or spools, or tubes.

2483. R. A. Brooman. Certain plastic compositions to be employed for building and decorative purposes, and in lieu of marble, stone, brick, and cement. (A communication.)

2484. R. Cichowski. Improvements in ploughs.

2485. J. Holmes. An improved halter-block for stable purposes.

2487. L. Pohl. Improvements in fastenings for bags, purses, and similar purposes.

Dated Nov. 1, 1859.

2488. C. and I. A. Read. A new or improved tap or stop cock.

2489. W. Spence. An instrument for taking and registering deep sea soundings. (A communication.)

2490. A. V. Newton. An improved mode of and apparatus for condensing and cooling vapour and fluids. (A communication.)

2491. J. Jones. Improvements in shipbuilding.

2492. W. H. Perkin. Improvements in the manufacture of colouring matters.

2993. R. De Bary. Improvements in machinery for the manufacture of cigars. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Nov.* 15, 1859.)

1591. R. A. Brooman. Cementing, refining, and steelifying iron. (A communication.)

1606. S. Lloyd. Cast steel tyres.

1608. B. Seed and T. Steel. Treating soap-suds.

1609. J. T. Edmonds. Winnowing machines.

1615. Sir F. C. Knowles. Iron castings.

1616. J. Smith. Propelling.

1619. G. Ellis. Muffs.

1623. J. Gibbs. Brushes, &c.

1629. W. H. Harfield. Capstans and riding bits.

1630. H. Brinsmead and J. Lawrence. Screens.

1631. J. Taylor. Walls.

1632. T. D. Duppa. Carpenters' benches.

1634. W. N. Nicholson. Machines for making hay, and for cutting thistles, &c.

1635. W. N. Nicholson. Clod-crushers and rollers.

1642. J. Smith. Heating and cooling water.

1644. R. Clegg. Machines for cutting. (A communication.)

1653. C. J. Proal. Fabrics. (A communication.)

1656. W. A. Munn. Reaping machines.

1670. R. Longstaff and A. Pullan. Traction engines.

1678. W. O. Carter. Sawing slate.

1695. W. H. Harfield. Getting ships' anchors.

1698. J. Luis. Axle-trees. (A communication.)

1708. Z. G. A. N. P. Orioli. Bleaching and dyeing.

1726. W. H. Harfield. Capstans, riding bits, and stoppers.

1746. W. Hudson and C. Catlow. Looms.

1754. W. Clark. Turning over music leaves. (A communication.)

1776. T. W. G. Treeby. Targets.

2042. J. L. Jullion and G. Pirie. Gelatine.

2178. G. Addenbrooke. Raising and lowering boats.

2262. W. E. Newton. Blankets for printing. (A communication.)

2316. J. Skertchly. Tiles and slabs.

2328. C. P. Moody. Raising crops on to stacks.

2361. S. Newberry and H. Moore. Looms.

2392. C. Seton. Wheels.

2394. G. Hart. Hats.

2410. G. T. Bousfield. Steering. (A communication.)

2416. W. Fox and J. Willis. Umbrellas.

2423. F. N. Clerk and C. Thomas. Choppers.

2439. E. Ellis. Lace.

2477. J. A. Turner. Paper.

2490. A. V. Newton. Cooling fluids. (A communication.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Nov. 11, 1859.

1192. A. P. Rochette.
1214. S. C. Sheard.
1216. W. Midworth.
1224. A. R. Landre, P. Gras, and A. L. A. Boucherie.
1294. J. Mallett.
1870. W. Green and W. and F. B. Fawcett.
1998. P. Wright.
2064. A. V. Newton.

Sealed Nov. 15, 1859.

1219. G. Allcraft.
1226. A. E. C. J. Reynaud de Trets.
1227. J. Nasmyth.
1231. E. Charlesworth.
1232. S. N. Evans.
1238. R. A. Brooman.
1240. J. Valda.
1241. G. Walker.
1244. G. J. Parfitt.
1282. G. Hadfield.
1334. J. L. Norton.
1354. S. and J. Wood and P. Billington.
1360. J. B. Pascal.
1365. R. Mushet.
1384. W. Green.
1385. C. Pooley.
1404. J. H. Tuck.
1405. E Welsford.
1438. E. Humphrys.
1445. W. Birkmyre.
1474. W. Clark.
1483. A. V. Newton.
1491. W. E. Newton.
1551. J. J. Griffin.
1847. W. Mac Lellan.
2193. T. Sutton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2629. W. Porter.
2639. H. Bessemer.
2641. A. Barlow.
2642. F. J. Manceaux and E. N. Vieillard.
2645. J. Somerville.
2648. W. Smith.
2657. J. Bernard.
2668. R. A. Brooman.
2671. W. Green, jun., and T. Storey.
2674. C. W. Dixey.
2680. J. Kinniburgh.
2681. W. E. Cochrane.
2700. N. P. J. Leseure.
2706. J. Billing.
2768. A. Clark.
2777. W. E. Laycock.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

685. R. Knowles.
709. G. Lucas.
721. C. Bloomer.
755. J. Robertson.
808. G. Wilson.
832. J. Beale.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Nov. 11, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
837	0 3	850	0 6	861	0 8	871	0 6	881	0 4	891	0 7
838	0 3	852	0 5	862	3 6	872	0 3	882	0 3	892	0 3
839	0 3	853	0 7	863	0 6	873	0 7	883	0 6	893	0 3
840	0 3	854	0 3	864	0 3	874	0 3	884	0 7	894	0 3
842	0 3	855	0 10	865	0 3	875	0 7	885	0 7	895	1 5
844	0 9	856	0 3	866	0 7	876	1 10	886	0 5	896	1 0
845	0 9	857	0 7	867	0 6	877	0 3	887	0 5	897	0 3
847	0 3	858	0 5	868	0 3	878	0 7	888	0 9	898	0 3
848	0 6	859	0 3	869	0 3	879	0 3	889	2 8	899	0 9
849	1 1	860	0 5	870	0 3	880	0 4	890	1 4	908	1 2

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

WROUGHT-IRON GIRDERS, *Calcutta and South Eastern Railway.*—For the ironwork required for a bridge of 128 feet 6 inches clear span for carrying the railway over Tolly's Canal, Calcutta. Copies of the plans and specifications price £3 3s. per set at office, Mr. Longridge, 18 Abingdon-street, Westminster. Tenders, 211 Greshamhouse, Old Broad-street, London, Nov. 25, at noon.

RAILWAY ERECTIONS, *Scotland.*—For a timber stationhouse and goods shed for the Dailly station of the Maybole and Girvan Railway; also a stone-built goods shed at Maybole station. Plans and specifications at the secretary's office, Girvan. Further information of the engineer, Mr. J. Miller, 25 Northumberland-street, Edinburgh. Tenders with the secretary, Mr. J. Maclimont, Girvan. Nov. 25.

RAILWAY STATION.—For the erection of the Kirby Stephen Junction station on the South Durham and Lancashire Union and Eden Valley Railway. Plans, &c., railway office, Barnard Castle. Tenders, Nov. 20.

COVERED PIER ROAD, *Scotland.*—For construction of a covered passage between the station and pier at Burntisland. Plans and specifications, the secretary of the Edinburgh, Perth, and Dundee Railway, with whom tenders, Nov. 24.

RESERVOIR, *West Melton.*—For a service reservoir, &c., and laying earthenware and cast-iron pipes for the supply of water to West Melton and portion of Wath. Drawings and specifications, Waterworks Company's Office, West Melton, and at the offices of Mr. J. M. Landborough, C.E., 23 and 24 Queensgate, Bradford. Tenders to the Rev. J. Boyd, West Melton, Nov. 24th.

MACHINERY OF A FLOUR-MILL, *Scotland.*—According to plans and specifications with Mr. D. Chalmers, flour-mill er, Dicksfield, flour-mill, Arbroath, to whom tenders Nov. 22.

SEWERING, *Enfield.*—For laying glazed pipes and forming certain tanks with a brick sewer at Ponder's End, and other sewage works. Plans and specifications, Mr. Beardmore, 30 Great George-street, Westminster, when bills of quantities will be supplied on payment of 10s. Tenders to Local Board of Health, Enfield. Nov. 24.

ASYLUM, *Rainhill, near Prescot, Lancashire.*—For certain alterations and additions to the County Asylum, Rainhill. Plans, office of Mr. H. P. Horner, 10 Basnet-street, Liverpool. Bills of quantities, Mr. J. Longrigg, Lord St., Liverpool. Tenders to Mr. T. Martin, at the Asylum, 21st Nov.

SCHOOL, *Eastleach Turville and Eastleach Martin, Gloucestershire.*—For the erection of a joint school and teacher's residence. Specifications, offices of Messrs. G. and P. W. Fowler, Eastleach Turville.

HOUSE, *Headingley.*—For the masons', bricklayers', joiners', and carpenters', plumbers', plasterers', slaters', and painters' work required in the erection of a villa residence, with stables, coach-house, &c., to be built at Headingley.* Plans, &c., office of Mr. T. Shaw, architect, 2 Belgrave-square, Leeds. Tenders to Nov. 24.

TAR, &c., *Walsall.*—For the tar and ammoniacal liquor made at the Gas Works, Walsall, for three years, from January 1st, 1860. Tenders, which stating price per ton of 210 gallons for tar, and also the price per 1,000 gallons for ammoniacal liquor, must be sent to the Commissioners' Clerks' office, Bridge-street, Walsall, Nov. 26.

CONVEYANCE OF TIMBER.—For the conveyance from Dean Forest to Pembroke Dockyard of about 349 ends of oak timber, containing about 470 loads, and from High-Meadow Woods of about 164 ends of ditto, containing about 255 loads. Tenders, Dec. 1, to Mr. J. Campbell, Deputy Surveyor of Dean Forest and High Meadow Woods, Whitemead Park, Coleford, where the form of contract may be seen, and further particulars obtained.

MANAGER.—An active, experienced man as foreman or manager of an agricultural machine-making and engineering work in Forfarshire. Applications, stating age, qualifications, and expected salary, No. 284, *North British Advertiser Office*, Edinburgh.

WATER-WORKS SUPERINTENDENT.—A man of intelligence and experience in water-works to proceed to St. John's, Newfoundland, about 1st April next, to superintend the operations of bringing into the town of St. John's a supply of water. The party applying must produce testimonials from competent engineers of his ability to carry out a plan of the proposed works, which are extensive, and to be able to construct embankments, the laying of pipes, &c. An engagement of two years will be given. Salary, £200 and free passage out. If the party gives satisfaction, may be continued in charge of the works. Apply to J. R. Forman, Esq., engineer of the works, 156, West George-street, Glasgow; or to Messrs. Baine and Johnston, Greenock.

MACHINIST.—A practical machinist, who thoroughly understands the management of newspaper printing machines. Apply by letter to the proprietor of the *Irish Times*, 4 Lower Abbey-street, Dublin.

FOREMAN OR MANAGER, *Engineer's Factory.*—Must be perfectly acquainted with every description of steam and general machinery, foundry and smiths' work, boiler making, &c. Full particulars, age, salary, &c., to S. M. F., Southampton.

WORKING FOREMAN *in an Engineer's Factory.*—Must be a good practical turner, fitter, and erector. Messrs. G. Thompson and Sons, engineers, Eccleston-street, East, Pimlico.

CONTRACTOR'S PLANT TO BE SOLD, *Scotland.*—By private treaty at Silloth Dock, near Carlisle. Two twenty-horse high pressure horizontal steam-engines, with rails, &c., complete; makers, Cowans, Sheldon and Co., Carlisle. Two sets of winding drums, driving gear, &c., complete, suitable for working inclines, or for colliery purposes. One locomotive engine and tender; maker, Hawthorn, Newcastle. One donkey engine for pile driving. Application to Mr. Nelson, contractor; Carlisle; or to Mr. Middleton, on the works, Silloth Dock.

PRICES CURRENT OF METALS.

London, Nov. 18th, 1859.

		£	s.	d.		£	s.	d.	Dis. p.c.
IRON: ●									
Rails in Wales and North of England	pr. ton	6	0	0	to	6	5	0	cent
Welsh Bars, in Wales	,,	5	17	6	,,	6	0	0	-
Staf. Bars, at the Works	,,	7	0	0	,,	7	10	0	2½
,, Hoops	,,	8	0	0	,,	8	10	0	-
,, Sheets, Singles	,,	8	10	0	,,	9	0	0	-
,, Nail Rods	,,	7	0	0	,,	7	10	0	-
,, Boiler Plates	,,	8	10	0	,,	9	0	0	-
Scotch Pig, M. Nos. Warrants, at Glasgow	,,	2	12	0	,,	2	12	6	cent
Do. No. 1, Good Brands	,,	2	12	6	,,	2	14	0	-
Scotch Bars	,,	7	10	0	,,	8	0	0	3
Swedish Bars, in London	,,	11	15	0	,,	12	0	0	3½
COPPER:									
Sheet and Sheathing	per lb.	0	0	12	,,	0	0	0	3
Tough Cake and Tile	pr. ton	107	10	0	,,	0	0	0	
Best Selected	,,	110	10	0	,,	0	0	0	-
Australian	,,	110	10	0	,,	112	0	0	-
South American	,,	100	0	0	,,	0	0	0	prm
Yellow Metal Sheathing	per lb.	0	0	10	,,	0	0	0	-
STEEL:									
Swedish Keg	pr. ton	19	0	0	,,	19	10	0	2½
,, Faggot	,,	21	0	0	,,	0	0	0	-
TIN:									
English, Block	p. cwt.	6	12	0	,,	0	0	0	3½
,, Bar	,,	6	14	0	,,	0	0	0	-
Foreign, Banca	,,	6	14	0	,,	6	17	6	cent
,, Straits	,,	6	9	0	,,	6	12	0	-
TINPLATES:									
Charcoal, I.C.	pr box	1	11	6	,,	1	13	0	3
Coke, I.C.	,,	1	5	6	,,	1	6	6	-
LEAD:									
Pig, English	pr. ton	22	0	0	,,	22	10	0	2½
,, Spanish	,,	21	5	0	,,	22	5	0	-
Sheet	,,	23	10	0	,,	23	0	0	-
SPELTER:									
On the spot	,,	20	15	0	,,	21	0	0	cent
For arrival	,,	0	0	0	,,	0	0	0	-
ZINC:									
English Sheet	,,	27	0	0	,,	0	0	0	1½
QUICKSILVER	pr. btl.	7	0	0	,,	0	0	0	12½

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, NOVEMBER 25, 1859.

THE EDUCATION OF NAVAL ARCHITECTS.

THERE is this unfortunate circumstance connected with education of every kind, viz., that it cannot be properly understood or valued by those who do not possess it. This is particularly true of professional education—probably more so in reference to naval architecture than in any other instance; and it is unquestionably the cause of that strange jealousy between educated and uneducated shipbuilders which is known to exist throughout the country. The gulf between the few thoroughly educated men and all the others is so great—owing to the comprehensiveness of the studies which the real naval architect must master—that we do not wonder at the want of harmony between the two classes.

The good old "practical" shipwrights (as all those who are utterly ignorant of mechanical principles are especially fond of calling themselves) are both a very wide-spread and a very self-satisfied race. Outside of Her Majesty's service there are exceedingly few shipbuilders who do not belong to this class; (and we are now alluding, let it be understood, to builders of wooden ships, and not to the many boiler-makers who have of late years set up in what is called the iron-shipbuilding line;) while within the Government service there is by no means any superabundance of persons who may fairly be ranked as masters of their profession. We do not for a moment desire to detract from the merits of good practical shipwrights. All the time they confine themselves to the duties for which they are competent—those of converting, shaping, and combining materials, and of conducting general shipwrights' work—we value them as highly, probably, as they value themselves. Much depends upon them, both in the public and in private service, and no sensible man would ever slight either their abilities or their services. But, unhappily, such men often make the mistake of, feeling and speaking with contempt of accomplishments which, to say the least, are as valuable as their own; and not unfrequently they are further guilty of losing sight altogether of their own deficiencies. Often and often have we come into contact with men who could not write a sentence of their own language intelligibly, or even speak one correctly, or tell a square-root sign from an Assyrian hieroglyph, or measure the stability of a ship any more than they could predict the place of the planet Neptune, and who nevertheless have spoken with the coolest contempt of those higher acquirements of which they cannot possibly form the faintest conception. Now, while we esteem these men as practical shipwrights, we should like them to understand that their ignorance and presumption are very reprehensible.

Many of the mistakes which are made on this subject spring from the foolish belief that the possession of a theoretical knowledge of naval architecture cannot co-exist with good practical abilities. But the fact is, the two things are perfectly compatible, provided only that sufficient time for the acquisition of both be allowed. A man may speak and write English and yet be a shipwright; he may be able to solve an algebraic equation, and have mastered the books of Euclid, and yet be a shipwright; he may even have so far made himself an accomplished mathematician as to be able to deal with the difficult questions which the true naval architect must comprehend, and yet be a shipwright. No man can, of course, do all this in a year, or in seven years; but if theoretical studies and practical shipbuilding experience be properly blended, there is no conceivable reason why men may not in due time become masters of both branches of their profession.

In the private service, unhappily, the theory of shipbuilding, or naval architecture, has been all but utterly neglected of late years. The "rule of thumb" has been the golden rule, and we should scarcely know to what private shipbuilders to turn for anything beyond it. And wooden-shipbuilders are now paying the penalty of their neglect. They have been content with so small a measure of scientific skill on the part of themselves and their shipbuilding officers, that as we have already intimated, mere boiler-makers have no hesitation in entering into open competition with them. Nor is their competition vain; on the contrary, the builders of wooden ships are rapidly falling behind in the race, and if they do not stir themselves while it is yet time, the iron-shipbuilders will beat them almost altogether from the field.

It may be well before proceeding further with these remarks to draw the attention of our readers to the views of one of the so-called "practical" shipwrights on the question now under our consideration. Mr. John Edye, C.B., F.R.S., late First Assistant to the Surveyor of the Navy, is one of this class of persons—a man who always seemed to us and others to have a natural contempt for science, courtesy, the Queen's English, and many other things that men of cultivated minds are liable to esteem; and in his evidence before the Dockyard Committee of Economy he has favoured us with his opinions. He says:—"I am of opinion that "the system of education in the dockyards only "tends to disqualify the workman for his practical duty, in many cases. I do not object to "education; I am a great advocate for it; but it "appears that by the present system, a number "of these young men, educated in the manner "they are, are dissatisfied with their situations, "and in after life become discontented with their "positions, but being burthened with young "families, that is their only tie to the service; "those who are not so leave to better themselves; so that Government has not benefitted "by the good intention. And as these young "men have the preference of advancement over "the practical workman, the latter becomes "dissatisfied with the mortification he is placed "in by the control of the educated youth, who "is greatly deficient in his practical duties "(which experience alone can be obtained by "long servitude), consequently the service "suffers. In all great establishments in the "river, both shipwrighting and engineering, the "duties are conducted by experienced, practical workmen; and I believe, further, that "you will not find in any of the establishments of shipwrighting or engineering that "the practical detail of the establishments is "conducted by theorists; as it is very evident "the practical man can conduct his duties with "the workmen, when the theorist only causes "confusion and embarrassment, which ends in "perplexity and loss of property, from the want "of proper control, by the inability of the "inexperienced."

We have quoted Mr. John Edye's language, exactly as it stands, in order that the luminous character of his ideas may be fully presented to the reader; and, having done so, we would ask where in the wide world could we look for a more striking proof of the necessity of education than these remarks of Mr. Edye's afford? Here we have a man who has held for many years the highest professional post in the service, and who is now sweetening his later life with a handsome pension, coming before a committee with trash like this!—telling us that certain men are "dissatisfied with the mortifi-"cation" they are "placed in"; talking of "con-"fusion and embarrassment which ends in "perplexity," and so forth. We might surely object to such a man offering any opinion whatever upon the subject of education. But, waiving our right in this respect, let us look for a moment at what he says. The words "I do "not object to education; I am a great advo-"cate for it," must be passed by as simply meaningless, or, at the best, as a concession to other people's better sense. He is opposed, he says, to the "present system" of education in the dockyards. But what does he mean by this? He cannot, of course, refer to the systems under which the members of the School of Naval Architecture, or those of the more recent School of Mathematics and Naval Construction were trained, because these systems no longer exist. It would appear, therefore, that Mr. Edye must mean the present dockyard school system; and, if so, it is manifest that he is opposed (whatever he may say to the contrary) to education itself, for no system can be simpler or more harmless than that in question. Mr. Edye has been pottering at Somerset House and Whitehall for so many years past, at a post to which he was raised by a man who understood but little more of naval construction than he himself, that he can have had but little or no immediate acquaintance with the working of the dockyard schools. Let us turn then to what is said of them by those who have had the system immediately under their eyes. And first we find Mr. Abethell, the present Master Shipwright of Portsmouth Dockyard, bearing very different testimony. He thinks the schools have had a beneficial influence on the young workmen, and does not consider that any too much time is spent in them by the apprentices. Again, Mr. Moody, Assistant to the Master Shipwright at Portsmouth, thinks the young men who come out of their time now in the Government Dockyards quite equal as shipwrights to the men from the private service, and better in respect of discipline. And, without going further, even Mr. William Edye, the brother of our first witness, and who was the Master Shipwright of Devonport Dockyard for fifteen years, thinks the dockyard school system "a very good system." It is in opposition to abundant evidence of this kind that Mr. John Edye presumptuously falls foul of the simple and effectual means of education which is offered to the apprentices of Her Majesty's Dockyards, and, in fact, of education itself. Were we to give such men as he their way, in respect not of shipbuilding only, but of all other mechanical arts, how long would England be ere she had to dip her flag to every trumpery foreigner? Let us have a better reason for putting a stop to education than Mr. Edye's, viz., that the ignorant get "dissatisfied with their mortification."

There is one fact to which Mr. John Edye refers, and which is often observed by other people, that cuts two ways. They tell us that young men trained in the Government service frequently leave it to better their positions; and this is doubtless the case. But why is it so? First, because the Admiralty are disgracefully backward in rewarding their best men; and, secondly, because private shipbuilders train exceedingly few clever men of their own. To the latter circumstance we have already referred. Private shipbuilders have done next to nothing in the way of cultivating their young men in the science of a profession which requires more study than any other. In the engineering trade the necessity of a careful

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and extended training in mathematical and physical science is well understood; but what shipbuilders know or care anything of such subjects, or seek to impart a knowledge of them to their people?

On the other hand the Admiralty have yet to make great changes in their modes of dealing with their trained servants. They have in their service the most skilful and educated naval architects in the world, but what have they yet done to distinguish or reward them?—what are they even now doing in recognition of their services? In their office at Whitehall, for example, they have several men of the very highest culture and ability, who are daily performing duties for which nothing but great natural endowments and prolonged studies could have qualified them—men whose superiors are certainly not to be found elsewhere. Yet they are content to write these gentlemen down Mr. —— in the Navy List, to call them "Draughtsmen," and to give them very low salaries; while in the very same offices men of the most moderate abilities and the plainest education are dubbed Esquires, designated "Clerks," and have liberal salaries bestowed on them! And in the dockyards matters are no better. Some of the young men who were trained at the late School of Mathematics and Naval Construction have been shamefully neglected, not to say obstructed, by the officers of the Admiralty; and more than one of them who are men of good ability are at the present moment, after seven or eight years of service, anxiously looking for inspectors' appointments at £125 a-year! Such a state of things is discreditable in this country, and the Admiralty cannot mend it too soon. In the private service far inferior men are in receipt of salaries treble and fourfold greater than those which the Government give to some of their best servants.

AUXILIARY STEAM POWER IN MERCHANT SHIPS.

OUR respected correspondent, Mr. Cunningham, R.N., the inventor of the method of reefing square sails which bears his name, has addressed us a letter, which will be found in another column, on the employment of auxiliary steam power in the mercantile marine. Mr. Cunningham's remarks apply especially, indeed we may say exclusively, to the Australian voyage, and his view of the matter is, that the advantages of applying an auxiliary screw to vessels making that voyage have not yet been satisfactorily demonstrated. The subject is a very broad one, and we notice it here without the least expectation or intention of dealing with it either fully or finally; for to do this we should require more numerous and comprehensive data than we happen to have before us. But there are a few facts which may be mentioned at once with advantage.

And in the first place we would remark that our position in reference to the question is less that of an advocate of the auxiliary screw than that of one averse to a too hasty condemnation of it. In our article on the Royal Charter, we simply argued that the loss of the ship in no way proved the screw propeller "baneful," and that, on the contrary, that instrument had really proved of great advantage to her on her very first voyage; while in the foot-note which has occasioned Mr. Cunningham's letter we merely dissented from the conclusion that it was "questionable whether *any advantage* has been "obtained at all" by the use of the screw. This being our attitude—one of simple resistance to a too hasty condemnation of the auxiliary screw—we are at a loss to see that Mr. Cunningham has in the least degree made our ground untenable by his present letter. If the screw is to be utterly rejected from Australian vessels let us have the reasons for its rejection clearly set forth. Mr. Cunningham's statements amount to no more than mere *suspicions* of its inutility.

We said in our former article, on Dr. Scoresby's authority, that the Royal Charter overtook a vessel on her first homeward voyage, "and found that her own steam power had "enabled her to gain 4,000 miles upon the "other vessel in forty days." To this Mr. Cunningham refers, but only for the purpose of slurring the fact over. Now, we think it is a fact which should not be slighted; a *gain* of 4,000 miles in forty days is an advantage which must possess great weight in the determination of the question now before us. On again referring to Dr. Scoresby's Journal, and glancing roughly through it, we find that the steam power was applied to the Royal Charter on at least fourteen occasions during her first voyage to Melbourne, for intervals varying from half-a-dozen hours to as many days; and that on her homeward voyage it was employed no less often —once for fourteen days at a stretch. It will be seen from this that when Mr. Cunningham mentions "eight days" as a possible gain he gives the screw credit for far too little. If he had said from fifteen to twenty days he would have been nearer the truth, in so far as the Royal Charter's voyage is concerned. Nor is hers an unexampled case. We have before us the fact that the Kent, a ship which left Melbourne on the 1st of March, 1855, made a splendid run round the Horn and northward to the Equator in 40 days only, but was then kept almost in the same place by light winds and calms for no less than 17 days, during which long period she "accomplished "almost nothing." And there is but little doubt that like facts might be accumulated in abundance. We have not, as Mr. Cunningham implies, advanced the rapidity of the Royal Charter's voyage "as a *conclusive* argument" against his former remarks; but we nevertheless consider that the record of that voyage affords great reason for doubting the correctness of his view of the matter.

At the same time we are quite willing to admit —nay, are anxious to have it understood—that the Cunningham system of reefing sails does, as our correspondent contends, offer great facilities for shortening voyages. With the old system of shortening sail it is most dangerous to carry on a press of sail at times when with the Cunningham system it is perfectly safe to do so. Dr. Scoresby's journal, upon which we have already drawn for so many illustrations, indirectly throws some light on this point also. The Royal Charter was fitted with the American (Captain Howe's) system of double topsails on each mast. In this system the lower topsails are similar to close-reefed sails, but have their yards fixed to the lower mast heads, so as merely to traverse by the braces like the lower yards. The upper topsails, comprising one reef, are hoisted up by the yards in the usual way, and if required to be taken in suddenly, they may be dropped down before the lower sails, without requiring any further immediate attention. This plan is manifestly greatly inferior to Mr. Cunningham's; but at the same time it affords considerable advantage. Dr. Scoresby speaks of it very highly. In reference to a gale which occurred on the outward voyage, he says:—"In this gale we experienced the special ad-"vantage of the double topsails enabling us, by "the strengthening of two yards, to carry them "both throughout the night, and relieving the "men from labour and the ship from loss of "time and speed, by requiring, in almost the "heaviest weather, no reefing. All that is gene-"rally needful when, as in their present condi-"tion, the foot of the upper topsail is laced to "the head of the lower one, is to lower the "upper yard down, and leave the topsail to lie in "the calm of the other sail, quietly before it." In another place he speaks of these sails as "avoiding the necessity of reefing by the mere "lowering down of the upper sails; and so, "whilst saving the labour of a large number "of men, enabling the navigator to carry sail "fearlessly, even in the contemplation of bad "weather, from the facility afforded him of re-"ducing, almost by self-acting arrangements, "his topsails into their smallest dimensions." He also quotes special instances in which the facility of shortening sail was made actually available in time of exigency. We have only to add, on this part of the subject, that what Dr. Scoresby here says of the American system has been said a thousand times, and with far greater earnestness and urgency, of the Cunningham system, the author of which has in no way exaggerated its merits.

Mr. Cunningham is quite right in reminding our readers that his plans are as applicable to, and as useful in, screw vessels as sailing vessels, wherever, as is usually the case, the screw is but an auxiliary aid to the vessel's progress. We should like to see it at once adopted in all the light vessels (at least) of the Royal Navy, in which activity and efficiency are of the highest moment. We have some hope of seeing this accomplished.

As to Mr. Cunningham's concluding suggestion, respecting the application of steam power to the working of ships' sails and anchors, we need hardly say we shall at all times show ourselves favourable to every well-considered plan having this for its object.

THE COMPASSES OF IRON SHIPS.

THERE are few subjects of greater practical interest than that of the deviation of the compass in iron ships. In wooden ships the compass was erratic enough, and at the very beginning of the present century its variable nature engaged the attention of Captain Flinders, on his Australian voyages. This intelligent officer discovered many important facts connected with the question, and devised formulæ and modes of correction which are still applicable. He observed that the trouble of correction may be saved if a place can be found near the taffrail where the attraction of the iron at the stern will counteract by its greater vicinity the more powerful attraction of the centre and fore parts of the ship, and that should the attraction be too weak, it may be increased by fixing one or more upright stancheons or bars of iron in the stern. He further says, if a neutral station can be found or made exactly amidships, and of a convenient height for taking azimuths and bearings, let a stand be there set up for a compass; and if the stand must of necessity be moveable, make permanent marks that the exact place and elevation may always be known. Observations taken there should never undergo any change from altering the direction of the ship's head at any dip of the needle, but it will be proper to verify occasionally, and to compare azimuths and bearings with others taken on the binnacle. The course should also be marked by this compass, though the ship be steered by one before the wheel, a quarter or half point being allowed to the right or left according as the two may be found to differ. Mr. Archibald Smith, in his recent introduction to Dr. Scoresby's journal of a voyage to Australia, states that little can be added even at the present day to Captain Flinders' observations in regard to wooden ships. We may here add that Mr.

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Smith, in the introduction just mentioned, gives a summary of the proceedings which have from time to time been taken in order to clear up the whole question of compass deviation and correction, and the controversies which have arisen respecting it—controversies which, particularly in the case of that which was sustained by the Astronomer Royal on the one side and Dr. Scoresby on the other, have led to very useful results.

About 1840 a committee of scientific men and naval officers appointed by the Admiralty recommended the form of compass now used as the standard compass in the navy, and the correction of the deviation, not by mechanical corrections, but by "swinging" the ship, and obtaining a table of deviations to be afterwards applied to correct the observed courses and bearings. This system has ever since been successfully followed in Her Majesty's ships, under the superintendence first of Captain E. J. Johnson, R.N., and subsequently of Mr. F. J. Evans, Master, R.N., whose valuable paper on magnetism was published in the MECHANICS' MAGAZINE for July 15 and 22, 1859. The success of this method has indeed been so great that there is reason to believe no vessel belonging to the Royal Navy has been lost through the inaccuracy of her compasses since the Birkenhead's disaster. But in the mercantile marine the case is very different, since no uniform system has there obtained. "The profession of a com-"pass-adjuster," as Mr. Archibald Smith truly says, "has sprung up. Each compass-adjuster "corrects in his own way. The merchant cap-"tain does not understand the process. He "assumes that his compasses are correct till he "finds out that they are in error, sometimes by "shipwreck; and when he discovers the error "at sea he is unable to correct it himself, and "is obliged to navigate disregarding the com-"pass." In 1854, however, was appointed the Liverpool Compass Committee, consisting of Thomas Brocklebank, Esq., merchant and shipowner, Chairman; J. P. Palmer, Esq., shipowner, Deputy-Chairman; Thomas Court, Esq., Secretary of the Underwriters' Association, Treasurer; John Grantham, Esq., naval architect and consulting engineer, and John T. Towson, Esq., Secretary of Local Marine Board, Honorary Secretaries; Mr. W. W. Rundell, Secretary; some score or more of gentlemen appointed by the Shipowners', the Underwriters', and the Steam-ship Associations, and by the Literary and Philosophical and the Polytechnic Societies; and the following gentlemen, whose names were added by the General Committee, viz., Commander Bevis, R.N., Agent for Transports; E. Heath, Esq., President of the Chamber of Commerce; John Laird, Esq., iron-shipbuilder; Joseph Mondell, Esq., shipowner: W. Potter, Esq., Chairman of the Underwriters' Association; and Capt. Schomberg, R.N., the Chief Emigration Agent of the port. The names of Professor Airy, F.R.S., Astronomer Royal; F. J. Evans, Esq., R.N.; Rear-Admiral Fitzroy, F.R.S.; Major-General Sabine, R.A.; Dr. Scoresby; and Archibald Smith, Esq., M.A., F.R.S., were afterwards added to those of Honorary Members. This Committee was appointed to investigate the causes of the deviation of the compass in wooden and iron ships, and to ascertain the best means of correcting errors arising from this source, especially in iron ships; and has certainly prosecuted its inquiries with considerable zeal and success. Its first and second Reports have for some time been before the public, but have not hitherto gained all the attention which they deserve. Our present object is mainly to give them—the latter in particular—that increased publicity which they well deserve. In doing this we shall, for the sake of convenience and accuracy, adhere as closely as possible to the language of the Committee.*

At an early date it became apparent to the Committee that in pursuing their inquiries, besides the difficulties belonging to the subject, they would have to overcome the apathy of shipowners and the inertia or active opposition of persons interested in maintaining things as they are. Even when merchants and shipowners were willing to accede to the wishes of the Committee, they were met by the heavy expense and delays attendant on experimenting upon and moving such ponderous masses as iron ships. To these must be added impediments arising from frequent changes in ships' steering apparatus, and the position of the binnacle; from new fittings and the varying quantity and stowage of the iron in a ship's cargo; the proximity of other iron ships on the building slip, or by the wharf; and numerous other retarding or vitiating accidents which will readily suggest themselves to persons conversant with maritime affairs. In some cases there was reason to suppose that information forwarded to them was not to be depended upon; that with compass deviations arising from the iron of the ship, they were favoured with others due to personal and accidental causes, imperfect instruments, local attraction on the shore compass, and a bad system of "swinging." The returns made to the Committee, and really available for the inquiry, where by such causes so much reduced that it is chiefly by the co-operation of a comparatively small number of captains, and the strenuous exertions of the Committee, that any progress has been made. It is, however, believed that the Report contains valuable and trustworthy information respecting the direction and amount of what is now generally termed a ship's sub-permanent or retentive magnetism, and the fluctuations to which the more changing part of her magnetism is subject. That part of the inquiry which depends on observations made in other latitudes is for the most part reserved for the next Report, when the data in the possession of the Committee will be much increased.

Many of the difficulties and hindrances which have been alluded to were overcome by the introduction of a complete system of magnetic bearings, painted by request of the Committee upon the dock walls of the port of Liverpool, and the use in conjunction with these of a gimballed "dumb card." The pointed bearings, besides affording the captain of every ship which enters or leaves the docks or swings with the tide in the Mersey, the means of testing the accuracy of his compasses, have enabled the Committee to gather much important information which would otherwise have been quite unattainable. They have proved, too, most decisively that the deviations of the compass on board iron ships, when properly ascertained, are not of that irregular and erratic character which many cards of deviation might lead one to suppose, but that they accord most closely with the deductions of theory and experiment, as exemplified in the works of the Astronomer Royal and Mr. Archibald Smith. The Committee have been practically convinced that a good deviation table, when projected by Napier's or any similar method, assumes so simple, regular, and intelligible a form, that the practised eye can at once decide upon the degree of confidence it should command, and on the general distribution of the ship's magnetism at the place of the compass to which the table belongs.

The records of the Committee no longer allow a doubt as to the connection which exists (and upon which Dr. Scoresby so long insisted) between the direction of a ship's original magnetism and her position when upon the building slip. In all the ships which have been examined, the north end of the compass needle invariably deviated towards that part of the ship which was furthest from the north while she was building, if the compass was placed in a central position and free from the influence of individual masses of iron. When this is admitted, the following question is immediately suggested: Of ships built in various positions, which have the smallest deviating action on the compass? To answer this satisfactorily, it is necessary to consider not only the amount but the permanence of this action; to refer to experience gained in long as well as short voyages; and to free the observations from the influence of bulk-heads, pumps, rudder-head, and stern-post, or proximity to other individual masses of iron. This involves an amount of labour and research which few persons besides those who have attended to the subject will be able to appreciate. Before concluding their investigation the Committee hope to be able to give the question a practical answer.

The original magnetism of a ship, by which is meant that dependent on her direction when building, as it forms a leading characteristic, is first treated of by the Committee. In amount it appears to have close relation to the size of the ship or the quantity of iron used in her construction. In a ship of 400 tons, built head to east, where the deviation of the compass is always toward the starboard side, if a compass be carried fore and aft on the middle line, about three or four feet from the deck, the deviation may be ten or twelve degrees when her head is north or south. In a ship of 1,000 tons, it may under the same conditions be 25° or 30°, or more, depending to some extent on the breadth of the ship. This deviation of the compass to starboard in ships built with head to east, and to port in ships built head to west, must be remembered to be caused by a differential action only. Both sides of such ships (in north magnetic latitudes) attract the north end of the compass needle, as will be seen by approaching either side with a compass, either internally or externally. One side, however, attracts the needle more strongly than the other; and this is the side which was furthest from the north when the ship was building. In discussing observations made in opposite hemispheres, and in considering the effect of heeling, it is important to remember this. If these ships be turned with head to east or west, the north end of the needle will tend to the bow or stern respectively, according to the direction in which lies the greater mass of iron, except when influenced by bulk-heads, or proximity to bow or stern—the stern especially, as here the stern-post, rudder-head, and other masses of vertical iron will control the attraction of the remainder of the ship.

In a ship built head to north, or near it, there will be no apparent attraction of the needle towards the sides while she lies in a N. or S. direction. In all other directions a strong attraction towards the stern will be noticed, except the needle be carried very near to the bow or the aft side of a water-tight compartment, when the contrary action may be seen. At a considerable distance from the stern in such vessels the deviation may amount to 40°, and at three or four feet from the rudder-head to 100, 150, or even 180 degrees. In ships built head to east, where the attraction aft is

* Those readers who are not fairly acquainted with the laws of magnetism would do well, before attempting to study the remaining portion of the above article, to read the exposition of magnetical principles with which Dr. Scoresby has prefaced the volume which we reviewed two or three weeks since.

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not nearly so strong, the deviation of a compass placed near the rudder-head, &c., will approximate to these amounts. In one such instance the error in the first position of the binnacle was 101°. As the ship was going to the East Indies, the compass-adjuster objected to compensate so large an amount, and the binnacle was then placed three feet forward; here the error was reduced to two points. In another and much larger ship (the Dreadnought), the compass in the first position of the binnacle deviated 14 points; on moving it a little further forward, the error was reduced to 2½ points. To ships built head to south the same principles will apply. The deviation is chiefly towards the bow. Usually in these ships there is a space near the stern where the attractions are so nearly balanced that frequently no compensation of the steering compass is attempted; yet elevated compasses placed aft in the same ships will show considerable deviation, the errors increasing for some distance as the compass is carried aloft.

The prominent characteristics of ships built with head towards the cardinal points have now been described. In ships built in intermediate positions these characteristics will be combined. Thus, in ships built head to N.E. the attraction will be aft and to starboard; head to N.W., aft and to port. If the head be S.E. or S.W., the deviation will be forward and to starboard, or forward and to port respectively. But it must not be hastily concluded that those positions for building which give the smallest errors aft are to be preferred. The choice must depend on many other considerations. Ultimate permanence of deviation under change of geographical position is a quality to be more highly valued.

The original magnetism of an iron ship is frequently very permanent as regards direction, but is believed to undergo rapid changes in its amount, both in reality and in its apparent effect on the compass; the most striking change being at and immediately after launching, and during the first voyage. It is usually more evident in a steamer than in a sailing vessel. There are cases in which the deviations in a steamer have changed so much as two points in the first two days at sea, while afterwards the change has not been more than three degrees in as many months. The deviation of the Great Eastern's compass as she lay at Portland amounted to about twice as much as it was found to be subsequently at Holyhead—showing that her voyage between the two ports shook out of her a considerable portion of the magnetism which the iron hull exerted upon the compass. A change took place to a considerable amount (not far from two points!)—a fact which tends to strengthen our confidence in the practice adopted in the Royal Navy of finding the deviation at every opportunity. In new sailing ships the change is generally, but not always, more gradual, and extends over a longer period. A change of 10 to 15 degrees is not unfrequent. In proof of this may be quoted the general testimony of compass-adjusters. Each time a ship is re-swung, the compensating magnets are usually placed at a greater distance from the binnacle, or one or more are taken away altogether. In such instances there can be no doubt as to a reduction of the ship's magnetism having taken place. In the comparatively few cases in which compensating magnets have been added or placed nearer to the binnacle, the contrary inference is not so certain. The magnets may have lost their power more rapidly than the ship hers, or the ship's force in one direction may have been unmasked by a more rapid change in another, examples of which are on record.

Under some circumstances considerably more than one-half of a ship's original magnetism, or rather that part of it which affects the compass, may be lost, or may become balanced in the course of a year. Of this the Royal Charter is an example, as the following letter from the Astronomer Royal will show:—

Royal Observatory, Greenwich, Oct. 2, 1859.

My Dear Sir,—Business of the Observatory has prevented me for some time from examining the observations of the deviations of the standard compass in the Royal Charter, which you were so kind as to send me. I have, however, now taken them up, and find the following results:—

1. Quadrantal deviation.

Liverpool, 1856,	January	+ 6° 40′
Melbourne, „	May	5° 50′
Liverpool, „	August	5° 51′

These agree well with each other, and with the values which you had deduced. Their magnitude shows that the use of a mass of soft iron, to produce correction of the quadrantal deviation by its transient induced magnetism, must never be neglected. In this instance it would have left an uncertainty of 12°. I fear persons who correct compasses have been too much in the habit of omitting this.

2. Ship's sub-permanent magnetism towards the head (estimated in absolute measure in Gauss' manner, the units of measure and weight being the English foot and English grain). Whole horizontal force of terrestrial magnetism at Liverpool = 3·54; at Melbourne = 5·94.

Liverpool, 1856,	January	— 0·199
Melbourne „	May	— 0·147
Liverpool „	June	— 0·106

3. Ship's sub-permanent magnetism towards the starboard side, similarly estimated:—

Liverpool, 1856,	January	— 1·156
Melbourne „	May	— 0·895
Liverpool „	August	— 0·206

The value of these numbers will perhaps be best understood by remarking that at Liverpool a deviation of 1° will be produced by ·062 in either of these magnetisms; at Melbourne a deviation of 1° will be produced by ·104.

It appears, therefore, that the ship's magnetism (sub-permanent) has diminished in both parts of the voyage. The fore and aft magnetism has diminished very uniformly; the transversal magnetism has diminished more in the second or homeward part of the voyage than in the first or outward part.

Perhaps you may think fit to communicate this, with my best wishes for their success, to the Liverpool Compass Committee. I am, &c.,

G. B. Airy.

In support of the fact, the following are taken from a number of examples to the same effect which have been collected by the Compass Committee:—(1.) The Panic iron sailing-ship, built head to east; one of the oldest sailing iron-built ships in the port. It is stated that each time this ship has been swung the magnets were found to be too strong. When swung in 1856, after her return from the East Indies (to which she has made several voyages), one compensating magnet, a transverse one, was removed entirely; the fore and aft magnet was placed at a greater distance from the binnacle. (2.) The Sarah Palmer iron sailing-ship, built head E. by N. On the building slip at Warrington the attractions balanced each other between five and six feet from the rudder-head. A few days after launching, at Liverpool, head nearly in the same position, the balance did not take place till the compass was placed more than twenty feet further forward. Of a number of observations made on the deck-house, near the centre of this vessel, and similar observations made a few days afterwards, the ship's head being within 8° of the same direction, the average reduction of the deviations was from 37° to 11°. Making a liberal allowance for the small difference in the direction of ship's head, the change may be taken as from 3 to 1. (3.) The Astræa three-masted sailing-schooner, built head to south and west, was adjusted in the Clyde, and a table of residual deviations given. She sailed to the West Indies, and the deviations corresponded with the table. On the home voyage the Captain observed a change of nearly two points, and before he met with any bad weather. The difference was shown to be due to a reduction of the ship's magnetism by taking away the compensating magnet. There being no time allowed for re-adjustment, the magnet was again put in place, and she sailed to the Mauritius with deviation table, this being considered sufficient precaution for "clearing the Irish Channel and getting sea room." Recent letters show that she experienced still greater changes in going south. (4.) The Nauphante iron sailing-barque, built head east. Fore and aft and transverse magnetisms decreased after launching. (5.) The Bœotia S.S., built head south and west, was swung, adjusted, and table of residual deviations given to the Captain, who re-swung her immediately after, and before sailing from the east coast round to Liverpool. Before reaching the English Channel, the steering compass was discovered to be two points out, and the same amount of deviation was also observed by the pilot on bringing her into Liverpool.

The following easy mode of testing the fact which these cases illustrate is given by the Committee. It has frequently been adopted when no other presented itself, and is almost universally applicable. With a small pocket compass ascertain the direction of the north poles of the compensating magnets. This will indicate pretty correctly the direction of the ship's original magnetism. Observe the direction of ship's head, and whether any deviation exists. Cases in which sufficient deviation for this test is not to be found are extremely rare. It will be seen that the deviation is in the direction contrary to that which would be caused by the ship's magnetism, and is therefore due to the magnets being too strong. When the compensation is partly effected by chain-boxes, there can be no uncertainty on this point; in other cases the result may appear equivocal, unless the effect of horizontal induction be considered.

The Committee next inquire what would be the effect of such reduction of the transverse magnetism in ships built with head easterly, as is the case with so many vessels belonging to the port of Liverpool. It is evident that the north end of the needle of an adjusted compass will be repelled from the starboard side, giving east deviation on southerly, and west deviation on northerly courses. Further, if the reduction of the transverse magnetism forward from the binnacle affected the balance of the fore-and-aft attraction, the attraction of the needle towards the stern would be relatively increased, and there would also be east deviation on westerly, and west deviation on easterly courses. Thus, these vessels, whether on southerly or westerly courses, and particularly on southerly and westerly courses, would tend to the right of their course. That these ships do so is well known. To quote only one, though another and most painful instance will also suggest itself:—Captain Heron, of the Mystery, built at Warrington, head E. by N., states that after leaving Liverpool, with compasses adjusted, on her first voyage, he shaped a course for the Smalls, and kept to it. He found, however, that it took him so much to the right of his apparent course, that he considers he must have been about mid-Channel. Had he set a course for the Tusker, or even for mid-Channel, instead of one near the Welsh coast, the consequences might have been serious. From what has already been stated, it will be inferred that the larger the ship the greater will be the amount of change, and so much the more to the

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right of her course, under the same circumstances, would such a vessel be taken.*

After this early reduction of a ship's magnetism has taken place, the remaining portion, as far as may be judged from examinations made in the same place and under the same circumstances, appears to be comparatively permanent. The most striking case that can be quoted is, perhaps, that of the Great Britain. This extraordinary ship has been stranded, and strained, and altered; has traversed both hemispheres, and been very many years in active service; yet her lines of no deviation are now much the same as Dr. Scoresby would indicate them to have been when she was upon the stocks. The Great Britain also shows what has so frequently been insisted upon by Dr. Scoresby, that the tendency of these lines, with the lapse of time, is to approach the horizontal direction; but, except towards the middle of the vessel, little more than a tendency to it.

CAPTAIN BLAKELY AND THE ARMSTRONG GUN.

In another column we publish a challenge by Capt. Blakely to Sir Wm. Armstrong, or any of his champions, to make a 12-inch cannon. This is called forth by an article in the *United Service Magazine* (which is not without a certain official look), in which it is stated that Sir William no longer makes his cannon in the way he certainly did make his experimental and most successful one, and for which Capt. Blakely has a patent.

We hope to see Capt. Blakely's challenge accepted, for the matter is important to all taxpayers. Capt. Younghusband, R.A., in a paper communicated to the Royal Artillery Institution, and published by us in our edition of April 22nd, 1859 (page 261), tells us that Sir Wm. Armstrong first tried solid wrought-iron tubes for his cannon, but afterwards adopted a method which he thus describes:—

"A core, or internal lining for the gun, was "formed of cast-steel, to which the requisite "strength was given by encircling it with "twisted cylinders of wrought-iron, made in a "similar manner to gun barrels, and tightly con-"tracted upon the steel core by the usual pro-"cess of cooling after previous expansion by "heat; *the parts are then in that state of initial "tension which is necessary to bring their entire "strength into operation.*"

It is now said that the *initial tension* of the outer parts has been abandoned; and Capt. Blakely insists that, if so, efficiency and cheapness have likewise been abandoned. Now, a private individual has a perfect right to adhere to an expensive method a manufacture rather than pay a royalty for the use of a better and cheaper one, but the War Office has not the right thus to spend the money of the nation.

While we had Capt. Blakely's view of the case only before us, we refrained from expressing any opinion; but now that we have seen the reply, we have no hesitation in saying that he has much the best of the argument, and the monopoly of good taste and fairness in using it. Of the absence of the latter quality in the article of the *United Service Magazine* we will give one example. It accuses Capt. Blakely of quoting "newspaper accounts based on no "authority." It will hardly be credited that the "newspaper account" quoted is a letter from Sir Wm. Armstrong himself to the *Times*.

* The Naupliante is another instance of some interest, on account of the number of experiments which were tried on her for the Committee. After launching she was kept head to west for some time, this being the position most favourable to the reduction of her original magnetism. When ready for sea, her transverse magnetism was purposely under-compensated, in anticipation of further reduction, and the attraction to the stern, only about 3° or 4° when she was ready for sea, was *over*-compensated by nearly the same amount by a small bar of iron placed vertically within the skylight forward. The result was, as found by swinging her in the river as she was going to sea, to give a deviation of about 10° W. on a S.W. course, instead of allowing for the full amount of this error, the Captain steered only half a point west of his course, yet in spite of this precaution he saw both Wicklow lights when he considered himself to be well towards mid-Channel.

ON THE EMPLOYMENT OF AUXILIARY STEAM POWER IN THE MERCANTILE MARINE.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Bury, near Gosport, 9th November, 1859.

GENTLEMEN,—With reference to your dissenting note against the quotation from my pamphlet on the "Sail Power of Steam-ships," in the article in your late number on the application of my system to the Royal Navy, I beg to remark that at the time I wrote that pamphlet no remarkable passage had been made by screw steam-ships to or from Australia. I cannot now put my hand on the memorandum which at the time I had collected on the subject; but I remember that the length of passages of several of the screw ships which had made the Australian voyage exceeded that of sailing ships. I also remember being informed that many of the screw ships had sunk considerable sums of money in their voyages. The best proof of the success of anything is the extent of practical use to which it is applied. Why, therefore, do our Australian ship-owners not use steam-power more extensively than they do? And why do they stick so generally to the sailing ships? Furthermore, how was it that those companies who attempted the establishment of steam communication with Australia did not succeed in their spirited enterprise? It is true that the unfortunate Royal Charter had nearly completed the fastest voyage on record, but it has yet to be seen how much of this was due to the *sail* power as well as to the steam. In the article which you refer to in your note, it appears that on one occasion she logged 4,000 miles in forty days; although there was nothing very extraordinary in this run, still it would give her a good shove ahead; and we do not know what other good run she may have had under canvas. In the absence, therefore, of information on this point, I really do not think that the rapidity of the Royal Charter's voyage can be altogether attributable to her steam power, or can be advanced as a conclusive argument against the remarks alluded to. I have yet then to be convinced that except under the circumstances of immensely elastic trade, and, consequently, high freights, or unless with the help of Government subsidy, screw steam-ships can be run with success against sailing ships on the Australian voyage. Even supposing that by the aid of the steam power eight days could be saved in the voyage, which has yet to be proved, the additional expense of keeping the sailing ship and passengers for those eight days falls considerably short of the expense involved in supporting the costly steam-ship.

I do not for one moment wish it to be understood that I entertain the impression that sailing ships are altogether superior to screw steam-ships. It is only with reference to the Australian voyage that I imagine steam-ships have not evidenced the amount of superiority which it was considered they would do before the subject had been put to practical test. In conclusion, with reference to my views of improving the mechanical means for using the sail power, and by thus increasing the capabilities of the sailing ship bringing her up nearer to the capacity of the screw steam-ship for long voyages, I am happy to state that the experience of the past five years has quite confirmed me in these views. Some of the quickest voyages on record, both to and from Australia, India, China, and elsewhere, have been made by ships fitted on my system, and testimony is borne by the commanders that these voyages have been unquestionably accelerated by the ability which my system afforded them of keeping the amount of the sail power at a more equal rate than could be done on the old method, when the means of making and shortening sail was so laborious and difficult, and thus the speed of the ship maintained more durably, with considerable profit to the voyage. Some commanders have even stated that they consider they have saved ten days in the voyage from Australia. Although I am here alluding to the sailing ships only, consistent with the title of my pamphlet, this improved method of using the sail power applies equally to the screw steam-ships. It must not be overlooked that the ship has to depend much on her sails for long voyages. By all means, then, apply them in the most perfect manner possible to reduce labour and necessity for keeping up a large sailing crew. Bring her as much as possible under mechanical control, both aloft and below, and you perfect her as a machine. My impression, too, is that the steam power is not used so much as it might be in the working of the sails and anchors of the steam-ships. I cannot but believe that by suitable mechanical arrangements the windlass could be worked by steam, and that steam winches might be placed at different parts of the ship, to be used for working the sails. I was witness to this last suggestion being actually carried out. In a trial cruize on board of the Peninsular and Oriental steam-ship Pera, Captain Engledue had the topsail haulyard taken to the steam winch, and we reefed and unreefed her topsail (fitted of course on my system) with only one man to hold on the slack of the rope! What was done on board the Pera could surely be done on board of any ship.

I must really, however, apologise for having intruded so far upon your time.

I remain, yours, &c.,

H. D. P. CUNNINGHAM.

THE ARMSTRONG GUN—A CHALLENGE.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—In the October number of *Colburn's United Service Magazine*, my claim to the original invention of the means whereby Sir W. Armstrong obtains the strength of his cannon is combated on the pretence that Sir William now uses a different method. This question is easily decided by experiment, and perhaps Sir William Armstrong or some of his admirers will consent so to decide it. If so, I will bet five hundred pounds that I get a twelve-inch gun made on the principle said to be rejected which shall be cheaper and better than one made on any other plan.

I shall be exceedingly obliged if you will give publicity to this challenge.

I am, Gentlemen, yours faithfully,

T. A. BLAKELY.

Literature.

The Manufacture of Photogenic or Hydro-Carbon Oils, from Coal and other Bituminous Substances capable of supplying Burning Fluids. By T. ANTISELL, M.D., Professor of Chemistry. New York: D. Appleton and Co. London: 16 Little Britain, and Trübner and Co., 60 Paternoster Row. 1859.

DR. ANTISELL, the author of this volume, is officially charged by the United States Patent Office with the examination of a large class of patented chemical inventions, and is consequently in one of the very best positions conceivable for the compilation of a work like this, particularly as the library of the Patent Office furnishes a ready means of ascertaining the state of the manufac-

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ture concerned abroad. Dr. Antisell puts his treatise forth as "the first published monograph on the art of distilling oils from minerals containing bitumen;" and we believe he is correct in this. He has performed his task ably, and produced a valuable history of illuminating oils. The only errors which strike us are a few literal misprints of names, such as Grace Calvert for Crace Calvert, Belford for Bellford, &c.

Examples of Modern Alphabets, Plain and Ornamental. Collected and Engraved by F. DELAMOTTE. London: E. & F. N., 16 Bucklesbury. 1859.

THIS is a companion volume to Mr. Delamotte's "Book of Ornamental Alphabets," which we noticed some time since with much deserved favour. The present volume is not, in our judgment, all that, with the same labour, it might have been made, but it nevertheless contains a great variety of German, Old English, Saxon, Italic, Perspective, Greek, Hebrew, Court-Hand, Engrossing, Tuscan, Riband, Gothic, and Arabesque letters, together with an analysis of the Roman and Old English alphabets (large, small, and numerals) well adapted for the use of draughtsmen, surveyors, masons, decorative painters, lithographers, engravers, carvers, &c.

The Twenty-Sixth Annual Report of the Royal Cornwall Polytechnic Society. 1858. Falmouth: Lake, Market-strand. London: Simpkin and Marshall, and J. Weale.

WE can do nothing better, we think, with this volume, than notice it in this place. The Society seems particularly slow in getting its report before the public, and as it sends us no earlier account of its proceedings, it must of necessity suffer undue obscurity; but it is only fair to say of the "Report," now it is before us, that it is exceedingly well prepared, and deserves to be highly valued by the members of the Society.

On Wages, Trades' Unions, and Strikes. A Lecture delivered to the Operatives in Dunedin Hall, Edinburgh, on Saturday, October 12, 1859. By ADAM BLACK, Esq., M.P. London: Lockwood and Co., Stationers'-Hall-Court, E.C. 1859.

WE put the re-publication of this lecture on record because it deserves the careful attention of all those who need enlightenment on the laws and influences which regulate wages, trades' unions, and strikes.

Proceedings of Societies.

UNITED SERVICE INSTITUTION.

On Friday night COLONEL WILFORD, Assistant Commandant and Chief Instructor of the Government School of Musketry at Hythe, delivered a lecture ON RIFLES AND RIFLE PRACTICE. Lord Elcho, M.P., presided. Colonel Wilford introduced the subject of his lecture by a brief glance at the history and construction of fire-arms. Rifles were mentioned at a target practice at Hamburg, in 1498. They were described as muskets with a grooved inner surface; and from that day to the present rifle-matches had existed in Germany. The rifle was employed by the Jagers, who carried them for the destruction of game that required to be shot by ball. The Austrians did not at first train riflemen, for they found them ready made to their hands among the Jagers. Frederick the Great, in order to meet the Austrian army on equal terms, was obliged to employ riflemen. They remained unknown among English troops until the necessity for them was called forth by the war of American independence. The rifle was necessary to the existence of the backwoodsmen, and when they had the advantage of cover our troops could not stand before them. England was at first obliged to go to Hesse, to Hanover, and to Denmark for riflemen to bring against the Americans; and in 1794 the Government established the 60th battalion of Rifles, which was called the Royal American Regiment. Our first riflemen carried a mallet, with which to hammer down the ball; and the rifleman was so long in loading that it was necessary the red coats should be near that he might take refuge behind them while he loaded. The Duke of Richmond once said that in the Peninsular war our riflemen were supplied with tight-fitting bullets that would kill, and plenty of small ones that would miss, in order that they might have the pleasure of shooting off. It was at length discovered that the musket supplied to the English infantry was the worst in Europe—the heaviest, the shortest, requiring the largest ball, the greatest charge of power, having the greatest windage, the shortest range, and the least accuracy. It showed what the English soldier must be when he could gain such splendid victories with Brown Bess. The Caffre war was irksome and inglorious, and public attention became attracted to the shortcomings of our fire-arms. General Cathcart was sent out to the Cape with *carte blanche*, and what did he ask for? He said to the Government at home, "Send me out 4,000 Swiss." He wanted soldiers who could hit small objects at long ranges. Brown Bess was clearly unable to bringe the war to a close, for it was upon record that one morning 80,000 rounds of ball cartridge were fired, and only 25 Caffres were bagged. George the IV. was very anxious that the cuirass should be adopted in the British army, and that experiments should be tried to show whether it would resist a bullet. A cuirass was accordingly fixed upon a pole and Brow Bess was set to work at it, with the advantage of a "rest." The experiment would have been very satisfactory, only none of the balls could be persuaded to hit the cuirass. At last an officer put a musket to his shoulder, and by great good luck hit the cuirass, when the ball, of course, went through it. He believed that a man might sit in a chair, at 200 yards, and let a man blaze away at him all day with Brown Bess, with one condition only, that the shooter should be bound upon his honour to aim at the mark. A general officer told him that in Spain, being charged with the defence of a breastwork thrown up in a hurry, with a very few soldiers, the order was given to them to fire as rapidly as possible, not in any hope or intention of hitting anybody, but to make the enemy think they were stronger than they actually were. Firing to "make the enemy think!" Contrast this with what took place during the mutiny at Cawnpore. An officer, in command of his company, was attacked by some sowars (irregular native cavalry). He formed his men into two lines, made both kneel, and at the word "Fire!" 69 dragoons fell to the ground like a wall One man alone escaped the fire, seeing which a soldier came to the front, fired and brought the sowar from his horse at a distance of 300 yards. That was the way to "make an enemy think." Our troops were now all armed with the Enfield rifle, which was the best rifle made which, in similar numbers, had been placed in the hands of any army. By contrast and comparison with Brown Bess it was a weapon of transcendant value and superiority. Upon the beach at Hythe one day, when Sir John Burgoyne was present, a target was put up 8ft. by 6ft., upon which was outlined the figure of a man on horseback. A detachment of 32 men were formed in line at 600 yards distance, who lodged three balls in the horse and two in the man before an officer could get a glass to his eye. Sir John Burgoyne, when he saw this, exclaimed, "No dragoon can stand before you, and no artillery can stand before you unless it is protected." But a new gun required a new man. Men must be taught to shoot as they were trained in any other skilled calling. What was wanted was that all the men in a regiment should be taught to shoot, as all the dragoons in a regiment were taught to ride. In the Government School of Musketry shooting was taught as a drill, without ball at all. The gallant Colonel then entered into a technical description of "aiming drill" and "position drill," and strongly insisted upon the necessity of commencing rifle practice by snapping caps and firing blank cartridge. An important part of a rifleman's training was the ability to judge distances. It was not at first easy, but it could be learnt. The gallant colonel then proceeded to explain by means of diagrams the line of sight, the line of fire, and the trajectory of the Enfield rifle. The whole difficulty in firing bullets was that they were always travelling through the air at a curve, so that at long ranges it was necessary literally to drop them on a man's head. Armed with the Enfield rifle, no infantry soldiers ever need form a square to resist cavalry, unless surprised. The cavalry might come down upon them, but not a man would escape the aim of their rifles. We did not want the "common soldier" in these days. What was wanted was a taught, educated, and trained man. Some persons said that a range of 400 yards was long enough for the bulk of our troops, but if one soldier had a gun that would kill at 1,000 yards the man whose rifle would only carry 400 yards would not be able to get a single shot at his enemy. The only limit to the range of a gun was the power of the human eye. You might get a longer range by increasing the charge of powder and the weight of the gun, but the rifle then kicked, and where the recoil was great there was an end of accurate shooting. The weight of a gun was also an important consideration, for an infantry soldier required a weapon that he could carry in a 25 miles' march and fight with afterwards. How, then, was a longe range to be obtained? The resistance of the air to any object in motion was in proportion to the magnitude of its surface. In artillery the 68lb. ball, with a charge of 16lb. of powder, was at present the most accurate of aim, but in fire-arms the whole secret of extended range was in narrowing the bore. The Whitworth rifle was constructed on this principle, and at 900 yards' range the bullet from this rifle was going three times as fast as the Enfield. The greater the elevation a rifle required the more skill was wanted to drop the bullet down just where it would hit. It followed that the worse a soldier was the better his gun ought to be, and that the best guns ought to be given to the worst shots. Firing with the Enfield rifle at 800 or 900 yards he often missed the target twice out of five, and sometimes four times out of five, but with the Whitworth rifle he could hit it directly. Mr. Whitworth's rifle possessed the very great advantage of having a low trajectory, and the Enfield rifle the disadvantage of having a very high one; and it might be laid down as a rule in rifle shooting that the certainty of hitting was just in proportion to the lowness of the angle of elevation. [Lord Elcho begged pardon for interrupting the gallant colonel, but should be glad to know the difference in the trajectory of the Whitworth and Enfield rifles.] Colonel Wilford was sorry he could not answer the question. He had heard that the trajectory in the Swiss Federal rifle was very low. Perhaps, it would be more correct to say that the improvement made of late years in the rifle was not so much in the barrel as in the ball. He came there to assure them that accurate shooting could be acquired after a little drill, in a pleasurable manner, if they would only go to work in the same painstaking way as the volunteers who had recently been at Hythe.

INSTITUTION OF CIVIL ENGINEERS.

Nov. 15, 1859.—George P. Bidder, Esq., Vice-President, in the chair. The paper read was "On the Origin, Progress, and Present State of THE GOVERNMENT WATER WORKS, TRAFALGAR SQUARE:—with a few facts relating to OTHER WELLS which have been sunk, or bored into the chalk formation," by MR. C. E AMOS, M. INST. C.E. The author commenced by stating that a good supply of water having been required for the fountains in Trafalgar Square, it was determined, in the year 1843, to carry out a plan which had been suggested by Mr. James Easton. This was so framed as to include the water supply for the public offices. The water was to be obtained and raised by engine power, from the springs beneath the London clay. The quantity of water required for condensing the steam of the engine being too great to be taken from the main spring in full quantity, it was considered expedient to use cooling ponds; and it was thought that a small quantity of water in excess of that required for

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the public offices, running continually into the cooling ponds, would keep the water clean, and in a state fit for the purpose of condensation. The basins of the fountains were intended to form the cooling ponds. The water from them was to be taken for the use of the condenser, afterwards to be raised into a cistern, from whence it was to be conveyed to, and be passed through the jets of the fountains, where, meeting with the resistance of the air, it would be partially cooled and returned to the basin, for further circulation. Estimates having been made, it was found that the yearly interest on the cost of erection, added to the cost of working, would be less than the sums hitherto paid annually for the water supply to the public offices, and that, consequently, the playing of the fountains could be effected without cost to the Government. A contract was then made with Messrs. Easton and Amos for the execution of the works, and a piece of ground having been selected in Orange-street, the works were commenced in January, 1844, by sinking the first well to the depth of 174 feet. A cast-iron pipe, 15 inches diameter, was then driven through 30 feet of plastic clay and 10 feet into a stratum of gravel, sand, and stones, being left standing several feet up in the well. Within this another pipe of 7 inches diameter was driven through 35 feet of green coloured sand, and 3 feet into the chalk formation, and the boring was then continued to the total depth of 300 feet from the surface. A considerable quantity of water came from the sand, but a much larger supply was obtained from the chalk. A second well was sunk in the enclosure immediately in front of the National Gallery, to a depth of 168 feet from the surface. A pipe 14 inches diameter was then driven through the plastic clay, and into the gravel, sand, and stones beneath it. Within this a pipe 7 inches diameter was driven through 42 feet of green coloured sand, and 8 feet into the chalk, the boring being continued to the total depth of 383 feet. The springs were found to be stronger than those in the well in Orange-street. A tunnel 6 feet in diameter, and about 400 feet long, was driven to connect the two wells; the bottom of it being about 123 feet below T.H.W.M. A catch well 5 feet 6 inches diameter and 32 feet deep was sunk just outside the engine house. A tunnel was driven from it, passing beneath Castle-street and the National Gallery, to contain the pipes for bringing the water back from the basins of the fountains to the catch well. The paper then proceeded to describe the situation of the different tanks, or reservoirs, in the water tower, and their purpose; and next gave a brief account of the high pressure, condensing steam-engine, on the Cornish principle, for working two sets of pumps, one being capable of raising one hundred gallons of water per minute from the springs to the tank, and the other five hundred and fifty gallons per minute from the catch well into the tank for condensation and for the supply of the fountains. An auxiliary high-pressure, single-acting steam-engine was also provided, to be used when the principal machine needed repair. The works were finished in December, 1844. Their total cost, as completed, amounted to nearly £8,400. The water rose to within 90 feet of the surface (about 48 feet below T.H.W.M.) and was found to be of good quality. When the engine was pumping one hundred and ten gallons of water per minute, it could only lower the water 4 feet in the well. In 1846, a further demand for water having been made, a larger pump was substituted, which was capable of raising three hundred and fifty gallons of water per minute from the springs. In 1849, a second well was sunk in Orange-street, and an engine of 60 H.P., on Woolf's principle was erected. The well was carried to a depth of 176 feet, and a tunnel was driven to connect it with the other wells. A bore pipe was driven through the plastic clay, within which it was intended to drive a smaller pipe through the sand into the chalk, and then to continue the boring as in the other wells. But an accident having occurred in driving the large pipe, which allowed sand to come up the bore hole, and made the water foul, the hole was stopped with bags of clay, and no further use had been made of it, than as a sump-well to contain the pumps. The accident was accounted for in this way:—In driving the pipe great resistance was offered by the "hugging" of the plastic clay, and considerable percussive force had to be used. In consequence several of the screws which held the joints were shaken out, and the pipe having been improperly driven through the layer of gravel, sand, and stones, into the sand beneath, there was an escape of water through the screw-holes, and sand followed in sufficient quantity to cause inconvenience. The steam-engine worked one double-acting pump for supplying the fountains, and two other pumps for raising water from the springs into the tanks above the building. At an average speed of sixteen strokes per minute, the first could throw six hundred and sixty gallons, and the other two together six hundred gallons per minute. This engine is the one now mainly used. The supply of water from the springs was still found to be abundant. The pumping of six hundred gallons per minute lowered the water from 20 feet to 24 feet, when it remained stationary as long as the engine was kept working. The level of the water did not appear to be gradually lowering, and it was stated that on December 1st, 1858, it rose to within 66 feet of T.H.W.M., being about the same level as it stood in December, 1847. The author thought there could be no doubt that the greater portion of the water was obtained from the chalk. He then referred to the fact of the towns of Brighton, Croydon, Deal, Epsom, Ramsgate, and Woolwich, being all supplied with water from the chalk formation. There was an uncertainty, however, of obtaining a good supply from the chalk, as was illustrated in the case of the well sunk at Messrs. Truman's brewery. In 1857, a greater supply of water being required by the Messrs. Truman, it was determined to extend the works. In the first place the sand and water above the chalk were shut out, then the well was continued to a depth of 300 feet from the top, when it was discontinued, as no water came up the well hole. As the chalk showed indications of water at the depth of 285 feet, the floor of the tunnels was commenced at that level. These tunnels were 5 feet 6 inches high by 4 feet wide; that on the north side was driven to a length of 57 feet, and that on the south side to 48 feet. The quantity of water now obtained did not exceed twelve and a-half gallons per minute. The water of the springs in the sand had been taken by tapping the cylinders at the bottom, instead of, as hitherto, near the top of the sand stratum. A well sunk at Messrs. Combe's brewery, to a depth of about 48 feet into the chalk, produced a supply of seventy gallons per minute. The water stood 20 feet higher in this well than in the Trafalgar-square well, while the water in both wells was in a state of rest.

GEOLOGICAL SOCIETY OF LONDON.

November 2, 1859.—Professor J. Phillips, President, in the chair. William Fryer, Esq., St. John's Wood; Henry Curwen Salmon, Esq., Plymouth; and the Rev. Samuel George Phear, M.A., Emmanuel College, Cambridge, were elected Fellows. Dr. Ferdinand Roemer, Professor of Geology and Palæontology at the University of Breslau, was elected a foreign member. The following communications were read:—1. "On the passage-beds from the upper Silurian rocks, into the lower Old Red Sandstone, at Ledbury, Herefordshire." By the Rev. W. S. Symonds. 2. "On the so-called mud-volcanos of Turbaco, near Carthagena." By F. Bernal, Esq. In a letter to Sir R. I. Murchison, F.G.S. Turbaco is a village about fifteen miles from Carthagena, at an elevation of about 980 feet above the sea. At a distance of about three miles from the village, and at a rather higher elevation, in the midst of a forest, are some twenty or thirty conical hillocks, about 8 or 10 feet high, each with its little crater or orifice, about two feet in diameter. These are filled with a muddy water; and every two or three minutes a slight noise is heard, a bubbling-up of air or gas takes place, the muddy fluid runs over, and forms into cakes of blue clay. The water is quite cool, nor is there any present or anterior marks of vestiges of the action of fire or heat. 3. "On the coal-formation at Auckland, New Zealand." By Henry Weeks, Esq. Communicated by the President. 4. "On the geology of the south-east part of Vancouver's Island." By Hillary Bauerman, Esq. Communicated by Sir R. I. Murchison, F.G.S.

November 16, 1859.—Professor J. Phillips, President, in the chair. Thomas Harlin, Esq., Fellow of St. Peter's College, Cambridge, civil engineer; Julian Horn Tolmé, Esq., C.E., and Associate of King's College, London, 20 Queen Square, Bloomsbury; John Lancaster, Esq., Etruria Hill, Stoke-upon-Trent; the Hon. Robert Mersham, the Mote, Maidstone, Kent; and Arnold Rogers, Esq., F.R.C.S.E., President of the Odontological Society, 16 Hanover square, were elected Fellows. The following communication was read:—"Supplementary researches among the crystalline rocks of the north-west highlands." By Sir R. I. Murchison, V.P.R.S., F.G.S., &c. This communication was offered in corroboration of those views of the Author, already printed in the "Quarterly Journal of the Geological Society" (No. 59), which he first brought systematically before geologists at the Glasgow meeting of the British Association in 1855.

MEETINGS FOR THE ENSUING WEEK.

MON.—*Royal Geographical Society*, Evening Meeting. Papers to be read:—I. "Sun Signals for the use of Travellers," by F. Galton, Esq., F.R.G.S. II. "Latest Accounts of the Central Africa Expedition," from Dr. Livingstone, with illustrations. III. "Notes on Capt. Montgomerie's Map of Kashmir," by W. H. Purdon, Esq., Executive Engineer, Punjab.

TUES.—*Inst. Civil Engineers*, "On Arterial Drainage and Outfalls," by R. B. Grantham, Esq., M. Inst. C.E., at 8 p.m.

WED.—*Society of Arts*, "On the Prevention of Accidents in Coal Mines," by Mr. P. H. Holland, at 8 p.m.
Geological Society, I. Mr. T. W. Atkinson, "On some copper relics found in a gold-bearing sand in Siberia." II. Mr. W. Heaphy, "On the extinct volcanoes of Auckland, New Zealand." III. Rev. J. E. Woods, "On some Tertiary beds in South Australia," at 8 p.m.

LUDLUM'S PATENT LIFE-BOAT:

PECULIARLY ADAPTED FOR A SURF-BOAT, GUN-BOAT, SHIP-BOAT, OR PLEASURE-BOAT.

THE following description of this boat, which is now on exhibition at the Crystal Palace, has been submitted to us. All things considered we cannot perhaps do better than insert it just as it stands:—

"It has long been the study of the patentee to more effectually answer the call for help which so often comes from the briny deep. Knowing that in art the grand desideratum is the closest imitation of nature, always perfect in her undistorted offspring, he has seized upon this idea in the construction of his life-boat. In nature the bird has its wings upon its sides, and the fish its fins winged for action as circumstances require. Thus, also, because the floats of Ludlum's life-boat are made adjustable, so that either or both may be fastened by ropes or chains close under the sides of the boat, be extended horizontal with it, or be turned upward quite against or above the gunwales; therefore men within are shielded from shot, seas are not liable to break over it, and the two great defects of life-boats are remedied, viz., liability to capsize and want of self-righting power, in the same boat. The floats are of a conical or egg form in their transverse section, and constructed of cork, or of tin, (more or less,) canisters of zinc, gutta-percha, or for gun-boats of galvanised iron, and covered with wood. They are of such shape as to be well protected by the gunwales, and, with their attachments, may be varied to suit the different style of boats to which they are applied. Should the boat be placed bottom upwards, by a self-acting spring bolt she folds her fins or floats from an extended position, close under her sides, rights herself, and immediately extends them as before. The boat, in case of a self-righting and relieving one, is

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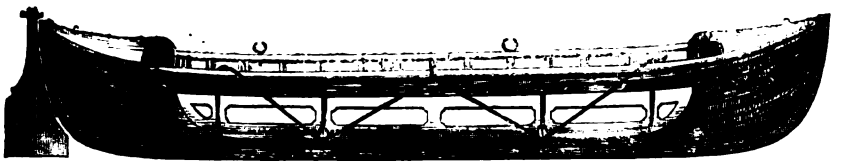
LUDLUM'S PATENT LIFE-BOAT.



constructed after the general principles of such boats, with a sufficiency of shear from stem to stern, with high bulk-heads, and with an inner deck, with valves opening to the bottom of the boat. These valves are balanced into place by a lever turning upon a pivot, and are opened downwards by pressure of water from above. The high bulk-heads are made of special service by placing in their bottoms water tanks, opening through faucets into the boat, and filling through tubes from above. Into the bulk-heads above the tanks are inserted valvular air-tight doors, thus creating lockers for the stowage of provisions, instruments, &c. These doors consist of an outer lid, hung and acting by a spring upon an inner lid, covered on its inner side with india-rubber, which is pressed against a rim around the edge of the door. They self-close by an elastic spring. A boat thus 'winged' or 'finned' would long sail a shipwrecked crew upon the open seas, would never swamp or capsize, and is so much like Nature as not to be improved upon. All its fixtures are simple, safe, and self-acting. A surf-boat, with this great length of beam-power, will not capsize; and if its bottom be broken upon rocks, its numerous water-tight compartments within and without will sustain any number in it, and the floats afford a most desirable resting-place for persons in the water. As a gun-boat for Her Majesty's men-of-war it is not easily destroyed by shot, while the buoyancy of the floats make it as fleet as any and much more steady. And for a pleasure-boat it is peculiarly adapted. How often are people drowned while taking an excursion caused by a sudden puff of wind, all getting upon one side, or by carrying too much sail. Now, it is evident the boat is very firm in the water, and that, with her floats spread, twice the canvas of an ordinary boat may also be spread. This boat when on exhibition at the Crystal Palace, in the City of New York, received the unqualified approval of a special committee of sea captains and master boatbuilders, and at the same time there was awarded it the first premium (a gold medal) from the American Institute."

The following is an opinion upon the boat furnished by Captain Hovey, master of the ship Amazon:—

"TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I have thoroughly examined the principles of Ludlum's life-boat, and having spent the past twenty-nine years sailing packet-ships between New York and London, and on one occasion being under Providence the means of saving 185 souls from a sinking steamer during a heavy gale, I am prepared to say I think this invention the greatest improvement of the age. Had I had this boat on the above occasion, in my opinion I could have saved several other lives lost by my boats capsizing.

"I have no further interest in this matter than is felt by yourselves, but hope to see it adopted in this country as more completely supplying the wants of the seas than any other style of boat.

I have the honour to remain, Gentlemen,

"Yours truly,

"H. R. HOVEY,

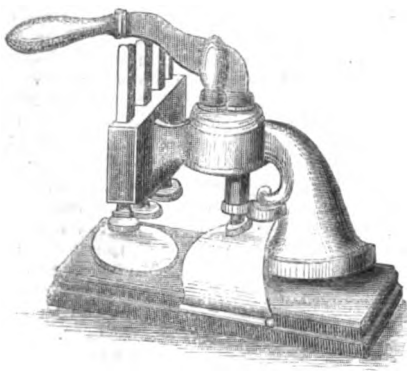
"Master, ship Amazon, X line.

"London, Nov. 19th, 1859."

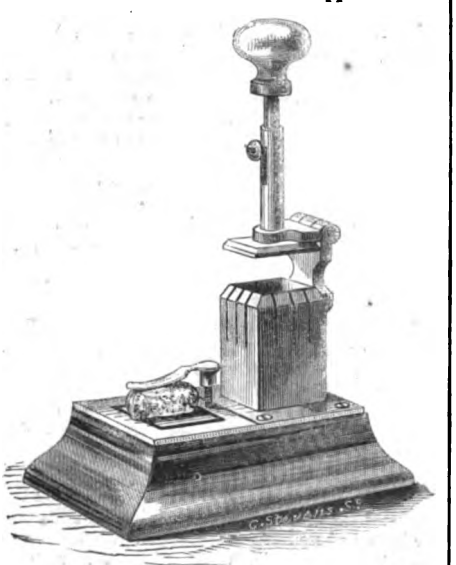
The Paris correspondent of the *Times* says that the English steamer Pilot, from London, landed three heavy guns, 68 pounders, strengthened at the breech. Also 1,000 shots for these guns, which were immediately forwarded to Paris for artillery experiments in the Polygone at Vincennes.

LOCK'S EMBOSSING AND STAMPING PRESS, AND STAMP AFFIXER.

THE accompanying illustrations show two ingenious articles lately brought to our notice by Mr. Lock, heraldic engraver, of the Old Jewry, London. The first consists of an apparatus com-



bining both embossing and stamping dies, which are supported by an arm of the ordinary description. In this apparatus the embossing die is fitted in a suitable socket provided with a spring, so that when the pressure of the lever is withdrawn, the die rises clear of the paper. The stamping die or dies are operated upon by the same lever being thrown over from the embossing die. The engraving shows three stamping dies, but any number up to six may be used in an apparatus of suitable size. The second is an apparatus for



affixing postage stamps on to envelopes. In this a box is provided to contain about sixty postage labels, placed singly one above the other, with the gummed side uppermost. The corner of the envelope is first damped by drawing its surface against a wet sponge, and then it is placed over the stamps, and held there by the operator, who forces down the knob, the pressure of which is sufficient to cause the top stamp to adhere firmly to the envelope. The sponge is kept moist by being connected to a small reservoir partly filled with water. The utility of these articles is evident.

SCOTT'S PATENT STEAM GENERATOR.

MR. G. SCOTT, an engineer of considerable experience, has lately undertaken to do a very important thing for us all—viz., to furnish us with steam boilers or generators which shall be cheaper, smaller, and more easily worked than our present boilers, and at the same time shall combine a very great saving in fuel with almost absolute exemption from explosion. In placing his views before us, with the view of obtaining publicity for them, Mr. Scott has reviewed the defects of the various well-known forms of, and modes of manufacturing boilers, and then dealt with the superheating system, which is growing in favour every day. Superheating the steam by late experiments has, as he says, shown a clear saving of 30 per cent., and is a step in the right direction as far as saving fuel is concerned, but it adds to the complication of the boiler, and leaves the danger of explosion more imminent than before. The old cumbersome boiler is retained with its large quantity of water undergoing the process of evaporation. The steam generated in the boiler passes through a number of pipes placed in the uptake, or that portion of the flue leading to the chimney, where they absorb the heat that would otherwise pass into the atmosphere and be lost, and by this means the steam is raised in temperature, and therefore in elastic force. This, in Mr. Scott's opinion, is beginning at the wrong end; "the object should be to superheat from the beginning,' or to use a homely 'expression, 'superheat from the word Go!' Allow me to propose the question," he says, "Where is the necessity for such large magazines of power, and of such large quantities of water contained in them? If we look in Nature, and notice the process of evaporation going on, we thereby learn the true mode. Notice how quickly the dew drops are evaporated by the morning sun, or a mist dispelled by the action of his rays. The finely divided particles of water are soon evaporated by the solar fire; or again, notice the evaporating effect of a drying atmosphere, how soon moisture is turned to drought. What is the effect of the hot wind of the desert? To parch, to evaporate, to extract the moisture from everything containing it. Let us remember another fact, viz., the denser a fluid is, the longer it takes to evaporate. Seeing, therefore, that these are natural phenomena, let us copy Nature, knowing the Supreme Architect of the world does all things well. Let us carry out these natural laws of evaporation, and apply them to the generation of a motive power, believing that if properly applied, fuel may be saved, space economized, and explosions rendered next to impossible."

In carrying out the preceding views Mr. Scott forms his generators of lap-welded wrought-iron tubes, one-fourth of an inch thick, formed into a coil as represented in the accompanying engravings. They may consist of any number of coils, one within the other, so as to occupy the whole space in the furnace, thereby increasing the generating surface, without increasing the space occupied by the machine; so also by using one coil, the generating surface may be decreased; or any number of these nests of coils may be enclosed in one casing, and acted on by one furnace, forming a generator of vast power. Tubes of any diameter, capable of being bent, may be used, or even straight tubes may answer the purpose, but he prefers the coil as great strength is combined in its circular surfaces, and it is admirably free from the evils produced by expansion and contraction, and being made in the form of a spiral spring, it is free to expand and contract within itself. The tube being welded, and being only a few inches in diameter, makes an explosion next to impossible. It consists of no joints or couplings to leak or become deranged, but each tube is one continuous length, even to the extent of 200 feet, if necessary. There is no difficulty in carrying a pressure of 300 to 500 lbs. to the square inch, on this small diameter welded-coil generator, with perfect safety. If 50 lbs. pressure be carried on one of the ordinary boilers, 30 feet long, 7 feet diameter plates, three-eights of an inch thick, all riveted seams, what pressure may be carried on a wrought-

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SCOTTS PATENT STEAM GENERATOR.

Fig. 1.

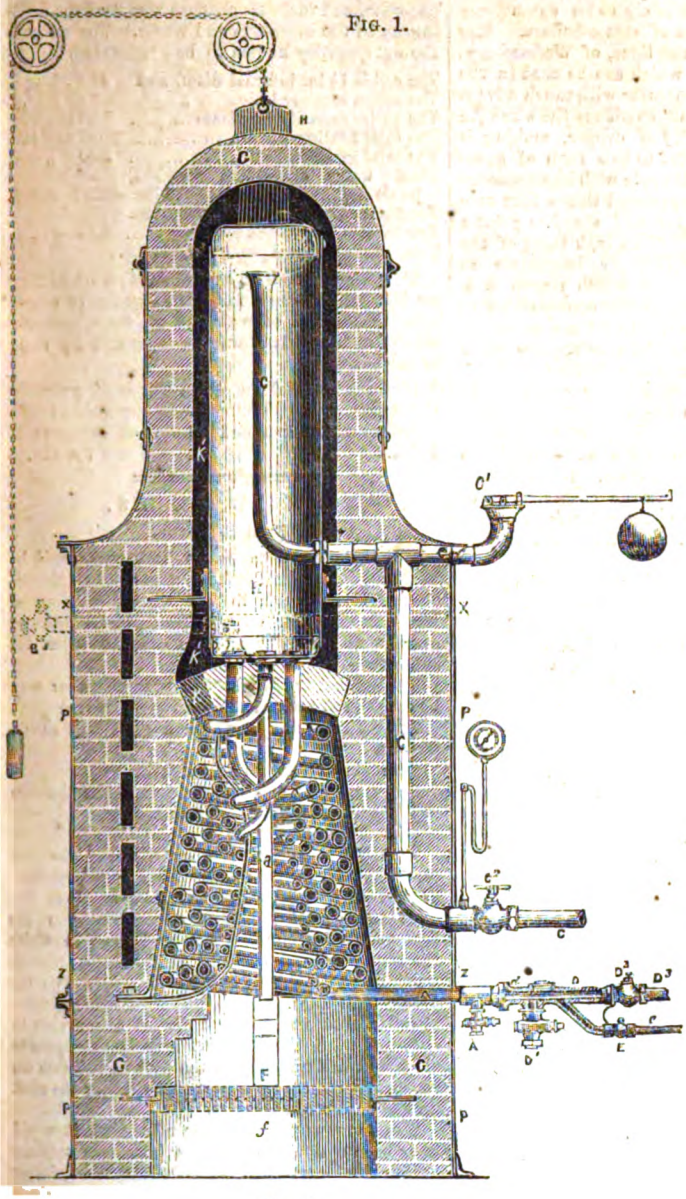


Fig. 3.

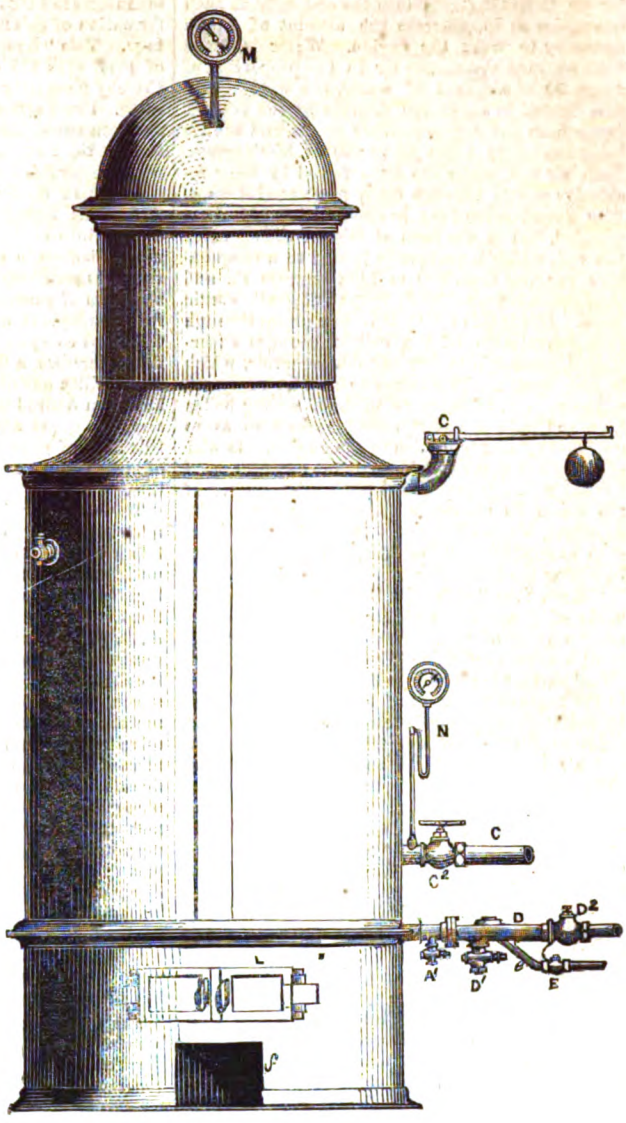


Fig. 2.

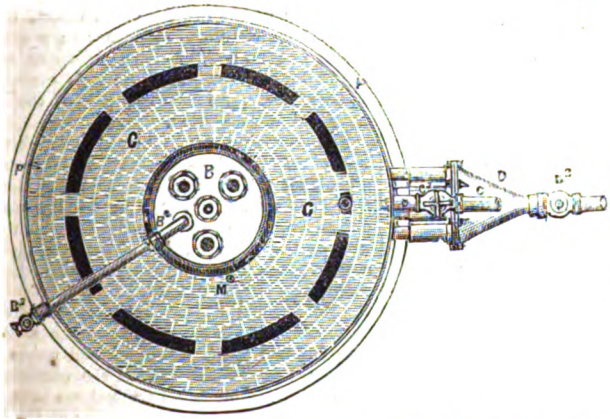
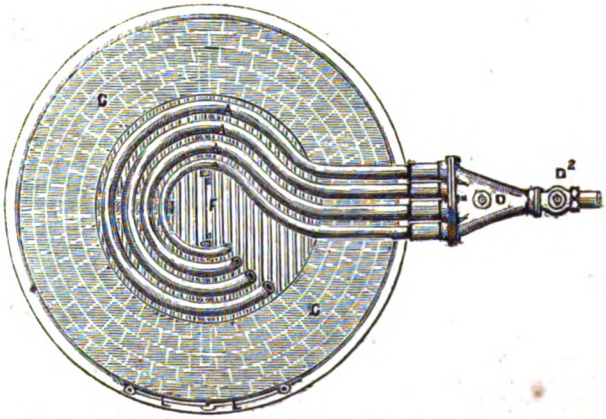


Fig. 4.



iron lap-welded tube, 2 inches in diameter, 100 feet long, and one fourth of an inch thick?—the 100 feet being coiled. Without going into the calculation, it is apparent, he says, to the most uninitiated in the science of mechanics, that the small tube will be capable of withstanding a greater pressure than the large one, other proportions being equal. It is to be noticed in this generator also, that the safety-valve, and the tube or boiler, are of the same diameter, and not as in other forms of boilers of very much smaller diameter.

Here, then, is described a form of generator capable of withstanding an immense pressure with safety. And, therefore, the expansive qualities of

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very high pressure steam may be taken advantage of in the cylinder of the engine, thereby saving fuel. But it is not in this alone the saving is effected. There is no large body of water for the heat to penetrate and act on as in the case of the old boiler two-thirds full of water. Water and air are together forced into the coil only in such quantities as to generate the amount of steam necessary to work the engine. Water is mixed with common atmosperic air in the proportion of about 30 of air to 1 of water, the water being first heated to about 200 degrees by the exhaust steam from the engine or other means, and the air being heated in tubes up to 400 or 500 degrees. Both air and water are then forced by their respective pumps through finely perforated discs of wire gauze, when they become intimately commingled, and in the form of mist or vapour enter the coil, which is previously heated to a temperature ranging from 800 to 1,000 degrees F., and thus steam is immediately formed of great elastic force. Nor is this all, as the steam passes through each convolution of the coil, it becomes superheated, passing into any suitable reservoir, which is also heated. This reservoir may be composed of any number of tubes, or made of strong boiler iron, and acts as a receptacle for steam, so as to guarantee a steady motion to the engine. It will be perceived that only that amount of water need be used which is required to saturate the air. If the steam be too dry, a little more water can be admitted, which will prevent any injurious effect, such as cutting of valves, &c., the water, in fact, becoming the lubricator.

"Here, then," says Mr. Scott, "we have the mode of generating a highly elastic gas with a small amount of fuel. In the first place the coil is all heating surface, or in other words, all its external surface is exposed to the action of the heat in the furnace, and none of the heat need be lost by radiation by properly clothing the coils and pipes with non-conducting substances. The water and air being introduced at high temperatures, and in a finely divided form, such as mist or vapour, are placed in the best possible state to receive the caloric, and require but a small quantity of fuel to produce sufficient heat in order to obtain a fluid of great elastic force. The heat necessary to thoroughly melt iron is 2,800 deg. F. If a pyrometer be attached to the furnace, it will indicate the amount of heat surrounding the coils, which may be steadily maintained at a temperature of 800 deg. or 1,000 deg., or any other that may be found necessary; by an apparatus which opens and shuts the damper or fire-door, the coils cannot be injured at this temperature, containing as they would at all times, a sufficient quantity of moisture; iron is improved in tenacity up to 600. The tendency to stop up by incrustation does not take place, as a person would be led to suppose, for it is generally found in the old boilers where ebullition is most, precipitation is least, and *vice versâ*. Under the peculiar circumstances of ejection above proposed, ebullition is constant all through the coil, the steam perpetually forcing its way to the cylinder. Two years' experience in using limestone water has not shown the least appearance of incrustation. In case of using a number of coils in nests for large power on board a steam-ship, each nest is furnished with a valve opening upward to the steam reservoir—the lower end with a blow-off valve. By opening the blow-off, the valve above closes, thereby cutting off the communication with the other coils. Thus, that nest only is blown off, when if the blow-off is stopped and the feed is opened, so soon as the pressure in that nest is equal to the pressure in the other coils, the valve opens. By this means each nest can be blown off separately without affecting the others. If any derangement of coils takes place, this valve closing cuts off all communication with the others. On board large steamers, using this form of generator, passengers would not be subject to that injurious heat between decks so much complained of, especially in tropical climates, and on board those carrying troops, this generator being so much smaller than the boiler now in use, and being clothed with non-conducting substances, between decks may become as cool as the external atmosphere."

Homogeneous metal, manufactured under the patent of Mr. Howell, is likely to be extensively used in the manufacture of steam-boilers. The Messrs. James Russell and Sons, of Wednesbury, manufacture tubes of it which can be used in the formation of this new generator with much advantage. This "homo metal" combines the strength of steel with the ductility of copper, making it thereby peculiarly adapted to this form of generator. From experiments made with homogeneous and iron tubes, it has been proved that a tube one-eighth thick of the former will stand as great a pressure as one a quarter of an inch thick of the latter. It does not oxydise or incrustate as rapidly as wrought iron, for which reason it is coming into extensive use in the construction of marine boilers in the navy. In its use many advantages are likely to arise from its application to this form of generator, such as a further saving of fuel, consequent on the tube being one-half the thickness compared with the wrought iron tube; it is, therefore, a better conductor of heat, while its ductility enabling it to be bent and shaped into any form desired is a desideratum. Its lightness, also, is a great advantage in the construction of this form of generator, and there is one in course of manufacture composed of it for public inspection.

The accompanying engravings represent a generator for driving a 50 horse-power engine. Fig. 1 is a vertical longitudinal section; Fig. 2 is a sectional plan through the line *X X* of Fig. 1. Fig. 3 is a front elevation; and Fig. 4 is a sectional plan passing through *Z Z* of Fig. 1. *A*, *A*, *A*, *A*, four coils of pipe in which the steam is generated (3 coils of 2" internal diameter and 1 coil ¼ ditto); *a*, *a*, stays to coils; *B*, steam receiver, to which the coils *A*, *A*, *A*, *A* are connected; *C*, steam-pipe; C^1, safty valve; C^2, stop valve to steam-pipe; *N*, pressure gauge; A^1, blow-off cocks to each coil; *D*, mixing box in which the air and water are mixed and forced through the wire gauge or perforated copper *d*; D^1, blow-of cock to mixing box; D^2, check valve to water supply; D^3, water supply connected to water pump; *e*, air supply connected to air pump; *E*, air check valve; *F* fire-bars; *f*, ash pit; *G*, fire brick lining; *R*, air space; *P*, wrought iron casing; B^2, pipe for blowing off steam receiver; B^3, blow-of cock to same; *L*, *L*, fire doors; *K*, *K*, *K*, three openings into flue K^1; *H*, damper to flue leading to chimney; *M*, pyrometer.

The following report upon the invention has been made by Mr. J. Finney, of the Poplar Iron Works, at whose establishment we saw the new generator in operation on Saturday last:—

Poplar Iron Works, October 17th, 1859.

Memorandum of experiments with Scott's steam generator fixed at this place to supply steam to an 8 in. cylinder, 12 in. stroke × 90 strokes per minute.

The coil driving this engine commenced work on the 9th August, and worked to the 22nd September and during this 40 days, or about 400 hours, it was often subjected to a temperature which produced on the lower portion of it a blood red heat, and then immediately subjected to cold applications, as the cold air on the outside and cold water pumped inside; after many severe trials of this kind, the tube was taken out, and was found quite perfect and unimpaired, and on cutting up the part which had been red hot, and submitting it to the usual tests, it proved not to have parted with any of its original ductility or strength, and by these means is proved to be as perfect as when it was put up.

During this time it was attended to by a young boy, and was subjected to all the changes and irregularities consequent on unskilled firing; the water used during this time was supplied to the coil cold, as it was pumped from the well on these premises, and proved on evaporation to be the most unfit water for steam purposes, and by analysis is found to contain an unusual quantity of earths, and for this reason its use is discontinued.

The experiments occupied the latter 15 days of the time, and extended over 165 hours, to test the consumption and evaporation. The coke used is gas-coke, and includes all that was used for lighting up in the mornings and waste. The water is the net quantity known to be evaporated.

The coil is 1¼ in. internal diam. and	47 ft. long
The steam receiver 12 in. "	2 ft. high.
The entire capacity for steam	1.92 cub. ft.
The total heating surface	28.86 sup. ft.
The total grate surface	3.09 "
Total water evaporated in 165 hours	31759.5 lbs.—529·5 cub. ft.
Total gas coke used	2893·0 lbs.
Total water evaporated per hour	3.05 cub. ft.
Total coke consumed per hour	23.45 lbs.

This is equal to 9.46 superficial feet of heating surface, and 1.2 super feet of fire grate to evaporate 1 cubic foot of water in an hour, and the result is 11 pounds of water evaporated by 1 lb. of gas coke.

During this trial the steam was used generally at a pressure of 100 lbs. on the square inch, on three occasions at 150 lbs., and on several occasions at 50 lbs.

JOHN FINNEY.

ON BELLS.

By E. T. LOSEBY.

The following remarks on bells were read by Mr. Loseby, at the Institution of Civil Engineers, on Tuesday, the 8th inst., after the reading of Mr. James' paper on the Westminster bells—a gentleman very competent to speak upon the subject:—

The subject treated in the present paper may be considered under the following heads:—

1st. The qualities which a good bell should possess.

2nd. How to obtain a good bell.

3rd. The causes which occasioned the fracture of the present Westminster bell.

4th. General remarks.

To begin with the first question: The best clock bell, according to my views, may be defined as that which shall weigh the least and yet produce the greatest volume of sound with the lightest blow of the hammer, and that in which the tone produced shall be of the most musical quality and capable of being clearly heard to the greatest distance. These qualities are requisite, in order that the greatest useful effect may be obtained with the smallest and least expensive clock and bell not only in the first cost, but in the constantly recurring expense of winding the clock up and repair of the parts.

These views appear so conclusive that it would have been difficult to imagine how two opinions could exist about them, had not the Westminster bells furnished evidence of views being entertained which are in direct opposition. In those bells the aim appears to have been to increase the thickness to an extent which required an enormously heavy blow to elicit the full tone. In fact, the great weight required for the hammer in proportion to the size of the bell, has been published as one of the best features which those bells contained. It is, therefore, quite time this part of the question were definitely settled.

2nd.—How to obtain a good bell:—The surest way of effecting this object would be to enter into a contract with one of the first bell-founders of this country, binding him to produce a bell entirely on his own responsibility, which shall be first placed in the tower and then be subjected by competent referees to certain specified tests relative to the weight of the hammer required to elicit the full tone, the musical excellence of the tone produced, and the distance to which it is heard, &c.; the bell not to be purchased unless the referees are of opinion that all the conditions have been fulfilled, nor until the bell has been in constant use a full year. An outline of the kind of trial referred to was published and submitted to me to the Board of Works about three years ago as the test to which the first Westminster bell should be subjected before being purchased, but the suggestion was not acted on by the Board.

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The outline of the trial the I proposed is equally applicable to any future bells that may be required: but as it may be found in the *Journal of the Society of Arts*, No. 214, and in the MECHANICS' MAGAZINE, No. 1737, I need not enter into further details here, and will only mention that the Government did not purchase the bells without going through the form of appointing referees to decide on their merits, but the object was entirely defeated by the designer of the bells being allowed to occupy the position of principal referee, and thus constitute himself the judge who was to pronounce an opinion on the merit of his own work. It is really amusing now to read the caution which I then submitted to the Government, and notice how completely the anticipations have been fulfilled.

3rd.—The causes which occasioned the fracture of the present Westminster bell:—The chief cause of fracture was undoubtedly the great weight and fall given to the hammer, which descended with considerably more force, in proportion to the weight of the bell, than the highest proportion which occurs in the instances that have come under my own observation; and before proceeding further I may as well caution persons against reposing confidence in the reputed weights and measures of bells, clappers, and clock-hammers, unless they have either taken the measures themselves or gleaned the information from a reliable source. Let us take St. Paul's, for instance. Here is a bell situated in the heart of London, and about which one would therefore suppose that every detail would be accurately known and published; but what is the fact? Why, if we consult a parliamentary return, No. 724, session 1847, we find that the fall of St. Paul's hammer is stated to be 10 inches, whereas the actual fall, measured by myself in 1857, proved to be only 3½, or little more than one-third of the reported quantity.

As St. Paul's is a well-known bell, I may as well employ it to show the comparative force with which the Westminster bell was struck. Taking the fall of St. Paul's hammer, therefore, at the reduced quantity which I found it to have, the force of the blow, compared with the weight of the bell, is still above the average proportion in my list, but it is nevertheless nearly seven times smaller than the proportion of force employed on the Westminster bell, and there is consequently no doubt in my mind about the force given to the hammer being the principal direct cause of fracture in the Westminster bell.

The great thickness of the proportions, which the designer perhaps introduced to carry out his published idea of the best bells being those which require the hardest thumps to make them sound, was no doubt the cause which necessitated the heavy hammer, and therefore the chief indirect cause of fracture, although the designer seems to have considered he was guarding against accident by adding to the thickness; whilst in reality the thickness had a directly opposite tendency, as I will endeavour to illustrate. If, for instance, we take two equal lengths of the same metal, one thick and the other thin, and bend them to an equal distance, we know that the thick length will be more likely to break than the thin one. Well, the circumference of a bell is the given length of metal, and it must be bent to nearly the same degree, whether it be thick or thin, before the full sound can be produced; and, as the hammer which would bend the thin bell will not sufficiently bend the thick one, its weight must be increased until it does so; and, therefore, instead of extra thickness adding to the security of the bell as it is supposed to do, it in reality increases the risk of fracture.

Another likely cause may be traced to the extra dose of tin employed in the composition, which exceeded the usual proportion by about one-fourth of the entire quantity. This would have been found to increase the brittleness considerably in frosty weather, and it may safely be classed amongst the causes of fracture, notwithstanding the mild temperature which prevailed at the time.

If I were to define the proportionate amount of effect due to each cause of fracture in something of an analytical form, it would be as follows:—

Force of hammer	8.
Extra dose of tin	3.
Uncertain	1.

4th.—General remarks:—It has been assigned, as a probable cause of the fracture, that the hammer occasionally rested upon the bell after the blow, and interfered with its free vibration. It is correct that the india-rubber recoil springs proved so inefficient as to allow the hammer to "chatter" on the bell, and that the tone was therefore impaired, but I cannot regard this circumstance as instrumental in cracking the bell, because in all bells which are swung the clapper invariably rests entirely on the bell after the blow, until the return oscillation.

Supposing large and small bells to be equal in quality, and otherwise uniform in their proportions, the larger they are the smaller is the proportion of hammer required to elicit the sound; and if the same proportion of force were employed on large bells which can safely be used on small ones, the result would be certain to end in fracture. Not only must the proportionate force be smaller for large bells, but it must also be applied in a more gradual manner, because it is impossible to set large masses in motion so suddenly as small ones; in fact, the velocity of the blow might be so great as to carry away the portion struck, without moving the distant parts of the bell at all. To prove this, I need only recall a few well-known instances, such as that of a bullet, fired from a musket, having sufficient velocity to make a round hole through a pane of glass suspended by a thread, without either cracking the pane or causing it to oscillate; the cannon-ball having so great a velocity as to be turned aside by water as completely as though the sea were a solid; and the piercing of a deal board by a tallow-candle fired from a gun. In these instances the velocity of the blow is too great to allow the surrounding parts sufficient time to partake of the motion, whereas with a lower velocity the whole pane would have been shattered, the cannon ball would have entered the water, and the candle would have been flattened out on the board like a pancake; and with a still lower velocity the pane of glass would simply have been set swinging, without fracture, and the candle would have gently rebounded from the board without its symmetry being obliterated. One of the chief things to aim at in large bells is, therefore, to impart the force slowly, and they should consequently be allowed to swing freely, so as to recede with the hammer and prolong the duration of impact. This may be done, and some other practical objects secured at the same time, by suspending the bell so that it can oscillate freely in the plane of the blow, but in no other, and so converting it into a pendulum swinging in tolerably equal intervals; the time of its oscillation having been ascertained, the interval between the blows is so regulated that the bell is always making one of its return oscillations as the hammer descends to meet it, and thus the swing given to the bell by one blow is set against that caused by the next, and the two made to neutralise each other, so that the motion does not accumulate at all, and therefore the recoil spring is only required to keep the hammer at little more than the distance that would suffice for a stationary bell, whilst the forces are so balanced against each other that all strain is nearly removed from the bell-frame.

It is hopeless to expect that an equal volume of sound can ever be obtained from a clock-bell—which must of necessity be comparatively stationary—as from bells that are rung, and therefore swinging through many feet of space. The view is quite erroneous which supposes the difference to arise simply from the hammer striking the outside of the bell instead of the inside, as a clapper does; and its unsoundness was proved by a bell which we fixed up at Leicester, with two hammers, one striking the outside, and the other the inside, when the outside hammer really produced the most sound, and its fall had to be a little diminished, in order to make the two sounds equal. The true cause is no doubt identical with that which produces the extra volume of sound when an accordian or concertina is swung about instead of being held stationary.

In bells, as in musical strings, there are certain points called nodes of vibration, which remain stationary whilst all the other parts are in motion. In strings the ends are fixed asunder, and the nodes of vibration therefore remain constantly at the same points on the string; but in a bell the two ends of the string may be said to be united, and the nodes of vibration to be at liberty to travel round the bell, and to occur occasionally at every point on its circumference. This will perhaps help us to explain the cause of one blow occasionally producing less sound than another, by supposing a node of vibration to be passing at the instant the hammer descends on the same point, and which would consequently have to generate another set of vibrations exactly antagonistic to those already existing.

The tone of the Westminster quarter-bells is of a decidedly musical character, and if the same musical type could be retained and combined with clear articulation, and the bells sound freely with only an average blow, a considerable advance would be made in the art of bell-founding. The fourth quarter-bell is a bad one, with a dull, leaden sound, and the tone is accompanied with a large number of "beats," arising from the different parts being out of tune with each other, and vibrating in unequal times, and which is owing either to imperfect proportions, unequal thickness all round, or unequal density of metal.

The Rev. William Taylor, who is nominally one of the referees for the Westminster bells, with limited powers of action, has informed me that he was at the pains of collecting and translating a large quantity of the most valuable information he could obtain from the Continent relative to the measurements and composition of foreign bells, but that very little advantage was taken by the designer of the Westminster bells, either of this information or of that collected by Professor Wheatstone. In addition to collecting information, Mr. Taylor has gone to the expense of making a number of experiments on bells, and it is therefore hoped that he will enrich this sterile field of inquiry by their general publication, when they may, perhaps, produce fruit under happier circumstances.

It is some satisfaction to turn from the Westminster bells to the structure which contains them, and witness the efficiency of the internal arrangements. The staircase, from bottom to top, is very wide for a bell-tower, and has landings conveniently arranged as resting-places. The bell-chamber is, perhaps, the most spacious in Europe, compared with the number and size of the bells it contains. The bell-frame combines strength with economy of material to a degree that enabled it to receive the disproportionately heavy hammer upon the bell without perceptible motion in itself; and the whole of this part, both in design and efficient execution, is really something pleasing to contemplate, and the pleasure will be shared by thousands of the public who will, in time to come, look down upon the bells from the iron gallery which has been so conveniently arranged for their use.

THE THAMES AND ITS IMPROVEMENT.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I have read with much interest the articles in the MECHANICS' MAGAZINE on this subject, and perfectly agree in the opinion given that the plans now in progress for metropolitan drainage will prove a most gigantic blunder, but as the local management (tinkers, tailors, &c., as *Punch* calls them), have it all their own way, they will go on to the end without doubt, when the rate-payers will wake up from their long lethargy, too late to recall the wasted and misapplied capital, which if it had been properly spent, would have diffused general benefit to all around, instead of adding to the evils by a perpetuation of Thames nuisances. These latter will not, however, be

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moved by pouring in sea water through pipes to the Thames from Brighton, for the fact is certain (as proved by daily experience), that wherever salt water and sewage are mixed together the stench is horrible, and produces a sickening and depressing effect on all around. This can be seen and felt every day in the large salt-water pond called the Mill Dam, at Portsea.

I trust your powerful protest will be used in preventing any addition to the great metropolitan nuisance; and which evil, if it cannot be cured must be endured, as long as men will quietly submit to have wrong principles carried out.

Yours respectfully, W. AUSTIN.

[We would remind Mr. Austin that in the plans to which he doubtless alludes, the object is to drive out the polluted water of the Thames by means of a quantity of sea water poured in above it,—and not to mix the two waters. Whether considerable admixture would be a necessary concomitant of these plans is, of course, a question to be considered.—Eds. *M. M.*]

UNSINKABLE SHIPS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Bury, near Gosport, 16th Nov., 1859.

GENTLEMEN,—With reference to the article in the number of your magazine of the 4th Nov., respecting "Unsinkable Ships," I enclose you a specimen of wood which I obtained at Madagascar about ten years ago, which you will perceive is of extraordinary lightness, and appears quite to come up to the requirement suggested by Mr. Atherton for the filling in of his unsinkable ships.

The piece of wood which I have sent to you measures $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4}$ inches, and weighs 20 grains, whereas a piece of well-seasoned fir of the same dimensions weighed 150 grains!

I regret that I cannot recollect enough about the tree from which this wood was obtained to give much information about it, but I believe it was a specimen of a cactus, the stem being about six or eight inches in diameter. The tree abounded about the Bay of Antongu, from whence I obtained the piece of wood now sent. It appears admirably adapted for ships, boats, &c. Probably you will be so kind as to pass the specimen on to the Society of Arts, as it may be viewed with interest after Mr. Atherton's paper. I am, &c.,

H. D. P. CUNNINGHAM.

[The specimen has been forwarded to the Society of Arts.—Eds. *M. M.*]

LIFE-BOAT SERVICES.

IT appears that during the present year the life-boats of the Royal National Life-boat Institution have at various points of our coasts been actively called into operation on fifty-six different occasions. The result has been that one hundred and thirty-four lives have been saved off twenty-three wrecks, besides assisting five vessels safely into port. On twenty-three occasions it happened that when the life-boats had put off in reply to signals of distress, the vessel either got out of danger or the crew was rescued by other means. Again, crews assembled several times to give assistance, but were not required to put off to sea. For these valuable services the crews were paid nearly 600*l*. Nearly all these services took place in stormy weather and heavy seas, and often in the dark hour of the night; and yet not a single accident happened to either of the life-boats or to one of the gallant fellows who had put off in them. On these and on occasions of quarterly exercise, these life-boats were manned probably by no less than 4,000 persons. Such practical proofs as these of the great value of the Royal National Life-boat Institution in a maritime country like ours, cannot possibly be over-rated, and surely it has the highest claims on our support; and the more we hear of its operations on various parts of the coast, the more we feel urged to press its claims on public notice.—Contributions in aid of this philanthropic cause may be paid into any of the Bankers of this town, or sent direct to the Secretary of the National Life-boat Institution, 14, John Street, Adelphi, London.

NOTICES.

The letters of Mr. De la Haye on unsinkable ships and rafts, of Mr. Cheverton on steam-ship economy, and of Mr. Moy on sailing, are all in type, but we are reluctantly compelled to defer the publication of them until next week.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5*d.* per line for any number of insertions less than 13; for 13 insertions, 4*d.* per line; and for 52 insertions, 3*d.* per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

[ADVERTISEMENT.]

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Scottish Central Railway, Locomotive Department, Perth, November 21, 1859.

DEAR SIRS,—Will you oblige me by inserting in your two next numbers that I do not claim the Originality of the Throttle Valve in the Blast Pipes in Locomotive Engines, as a means of retarding railway trains, though patented by me: for, since I did so, I have found it previously patented by Mr. RUDOLPH BODMER, of London, to whom any merit is due in introducing it in this country.

I am, dear Sirs, yours truly,

ALEX. ALLAN.

Our Weekly Gossip.

A WELL-INFORMED correspondent sends us the following statement respecting the Great Eastern's chain cables:—

London, Nov. 19, 1859.

GENTLEMEN,—Permit me to inform you that the quality of the iron employed in the chain cables of the Great Eastern was arranged by Mr. Lenox with Mr. Anthony Hill at the Plymouth Works. The construction of the cables rested likewise with him, and neither were dictated by the late Mr. Brunel, as implied in the letter of "Veritas" at page 331 of your last number, though no doubt conversations ensued upon the subject (after Mr. Hill received the order for the iron) between him and Mr. Brunel. I perhaps may, too, be permitted to mention that when discussing the size of cable to be used, Mr. Brunel energetically observed, "But we must not trust to one chain cable for holding such a ship; if she is driven to the necessity of applying her cables, three or four must be down at once." One alone has saved her on her *first* adventure.

SUBSCRIBER.

The prospectus has been issued of the London and Mediterranean Steam Company, with a capital of £50,000, in £10 shares. The object is to establish a line between London and the principal commercial cities of Italy and Sicily, the success of which is considered to have been rendered certain by the results of experiments carried on for two years past. The company also rely upon obtaining great advantage from the adoption of Rowan's patent expansion steam engine for economizing fuel, which has lately attracted much notice from its operation in the Thetis screw steamer between Glasgow and Liverpool.

The paddle steamer Emperor, of 1,350 tons, the property of Messrs. Gee and Co., Hull, clears to-day at that port for Santander. She is chartered by the Spanish Government for the war service in Morocco, and is the first of a line of British steamers taken up in this country for the Spanish war, being the only paddle steamer specially engaged for superior service. The Emperor was the steamer selected to convey the staff officers out to the Crimea in the late Russian war, with the late Captain Christie as commodore, and was also appointed to be the flag and signal ship during the transportation of the British army from Baldjik Bay, near Varna, to Old Fort, previous to the battle of the Alma.

The following letter from Miss Isa Craig is in support of the object to which our first leading article of last week was directed:—

GENTLEMEN,—As you have called public attention to the subject of the employment of women, I beg to inform you that at a meeting of the council of the National Association for the Promotion of Social Science yesterday it was moved by Mr. G. W. Hastings, and seconded by the Hon. Arthur Kinnaird, M.P., and carried,—"That the following be appointed a committee to consider and report to the council on the best means which the association can adopt to assist the present movement for increasing the industrial employment of women—the Right Hon. the Earl of Shaftesbury, the Hon. A. Kinnaird, M.P., Mr. E. Akroyd, Mr. Hastings, Mr. Horace Mann, Mr. W. S. Cookson, Mrs. Jameson, Miss Parkes, Miss Adelaide Proctor, Miss Boucherett, Miss Faithful, Miss Craig." If you will kindly insert this letter in your columns it will greatly facilitate the object of the committee, which is to obtain information as to the channels already open to female industry, and as to the opening of others into which it would be desirable to direct it. As secretary to the committee, I shall be happy to receive any communication on the subject, and am, Sir, yours obediently,

ISA CRAIG.

Waterloo-place, Pall-mall, S.W., Nov. 17, 1859.

In an interesting letter from Mr. W. Gilmour, of Aylesbury, for two years surgeon-superintendent of the Royal Charter, we read:—"In very rough weather, with a head wind, she (the Royal Charter) laboured very much, and shipped a great deal of water, which made her a very uncomfortable ship for passengers, more especially the third class. I have very often seen the water knee-deep between decks, and in sloppy wet weather the main deck always leaked, supposed to be from the working and straining of the ship. Indeed, I have seen the boards of the deck working up and down like the keys of a piano, and the seams all of a mass of froth. This I have frequently pointed out to the captain and chief officer. I have also seen and felt her vibrate from bow to stern like a fishing rod, and often, when great press of sail was on her, have heard the rivets rattling in her sides, but I must say never saw her leaking in any part only once, and that was a small one in her bows. These things I have more particularly noticed during the last two voyages before this unfortunate one, as I am thankful to God that I was not in her the last one. During these two voyages, but more especially the last one, I lost much of the confidence I had in her, and determined to leave her as soon as I could get a chance of settling down on land; in fact, such was my anxiety to get out of her, that I had a presentiment, which haunted me continually, that sooner or later she would be lost."

The *Courrier des Etats Unis* publishes the following:—"Mr. Millard Filmore, ex-president of the United States, has just addressed a letter to M. Rollin Germain, asking him to explain at a public meeting the principles on which this ingenious inventor believes he can build a steam-ship which will make 100 miles in an hour, and whose strength will resist all the fury of the ocean and even the shock of a collision with other vessels. When this steamer is laden with passengers, freight, provision, and coal for a voyage round the world she will only draw at the most 22 feet of water, and—a singular fact indeed—the expenses of the voyage will be only about one-fifth what it would be in the steamers now afloat. For 13 years M. Rollin Germain has been secretly studying his new system of mechanism and building, and eminent engineers in the United States have assured him that his discovery is destined to make an epoch in the history of steam navigation."

Mr. De St. Croix sends the following reply to "Inquirer":—

GENTLEMEN,—Upon the principle that he who meddles with science is bound to justify his interpretations of it when questioned, permit me to remark in reply to your inquirer wishing to know whether there is not some mistake in my statement of the relative angles of the screw on its axis, that the fan, and I might add just, interpretation of the diagrams contained in my little narrative of the screw's origin, that the fans of it, though at 90° of their axis, would, inversely twisted or feathered as represented, be 45° of each other's centre. If I am in error, and possibly our terms differing may make it appear so, the doubt may be easily disposed of if your inquirer, as a practical man or perhaps an engineer, will kindly take up the subject *pro bono publico* with as good a spirit to the oppressed as that which prompted the former communication of, Gentlemen,

Your obedient servant,

W. DE ST. CROIX.

Grove-end, Highgate, 19th Nov., 1859.

LIST OF NEW BOOKS.

Maury's Physical Geography of the Sea, 5*s.*
Ruskin's Elements of Drawing, 3rd edition, 7*s.* 6*d.*
Skyring's Builders' and Contractors' Diary, 1860, 2*s.* 6*d.*
Timb's Stories of Inventors and Discoveries in Science, &c., 6*s.*
Wharton's Examples in Algebra, for Senior Classes, 3*s.*

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Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

The abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 976.
BOILERS AND THEIR FURNACES, &c., 1005.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 947, 983.
SHIPS AND BOATS, including their fittings, *None.*
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 971, 972, 977, 980, 1003.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 989, 999.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 950, 960, 981, 984, 985, 991, 996, 998, 1006.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., *None.*
LIGHTING, HEATING, AND VENTILATING, 986, 989, 992.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 944, 945, 952, 953, 974, 979, 990, 1001.
METALS, including apparatus for their manufacture, 948, 956, 959, 962, 982
CHEMISTRY AND PHOTOGRAPHY, 957.
ELECTRICAL APPARATUS, 942, 951.
WARFARE, 965, 968, 984.
LETTER PRESS PRINTING, &c, *None.*
MISCELLANEOUS, 943, 936, 947, 945, 955, 958, 963, 964, 967, 970, 973, 975, 978, 986, 987, 988, 993, 994, 995, 1000, 1002, 1004.

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942. W. SINNCOCK. "Improvements in submarine and subterranean electric telegraph cables, and in machinery for the manufacture thereof." Dated April 14, 1859.

Here the patentee applies to the conductor one or more spiral or longitudinal layers of fibrous material saturated with a compound of india-rubber, gutta-percha, and bitumen. He next weaves an outer casing of yarns, threads, cords, or lines, of silk, cotton, flax, hemp, previously saturated in the aforesaid compound. *Patent completed.*

943. A. Mc. DOUGALL. "Improvements in coating metallic surfaces. Dated April 14, 1859.

This consists in coating metallic surfaces with a preparation composed of sulphur, heavy oil of tar, pitch, or asphaltum, and bees'-wax in certain proportions. *Patent completed.*

944. L. J. HIGHAM. "Improvements in billiard tables." Dated April 14, 1859.

This consists, 1, in making the cushion much lower than usual. 2. In making the angles of the cushion at the pockets more acute than heretofore. *Patent abandoned.*

945. S. BARNWELL and A. ROLLASON "Improvements in the manufacture of umbrellas, parasols, hats or hat covers, caps, capes, coats, mantles, dresses, gloves, and other similar articles." Dated April 14, 1859.

This consists in covering the above named articles with, or manufacturing them of, a silk, cotton, worsted or other woven fabric that has previously been dressed or coated with a preparation of collodion and oil. We cannot devote space to the details of the process. *Patent completed.*

946. G. ABEILLOU. "An extensible arching plane" Dated April 15, 1859.

This invention is not described apart from the drawings. *Patent completed.*

947. W. A. GILBEE. "Improvements in the construction of buffers for railway and other carriages, also applicable to other purposes where springs are employed." (A communication.) Dated April 15, 1859.

This consists in employing compressed atmospheric air or other fluid enclosed in a lenticular or other formed bag or receptacle, made of india-rubber, &c., such bag being surrounded by a moveable metallic ring or envelope placed within the buffer cylinder, and acted upon by a piston or plunger attached to the buffer head. *Patent abandoned.*

948. J. CHAPMAN. "An improvement or improvements in the manufacture of angle iron." Dated April 15, 1859.

This invention is not described apart from the drawings. *Patent completed.*

949. G. ASHCROFT. "Improvements in working presses and other hydraulic machines." Dated April 15, 1859.

The patentee claims the working of presses and other hydraulic machines by the employment of an accumulator combined with a force pump or force pumps as described. *Patent completed.*

950. R. BOOT. "Improvements in treating sheep or other pelts, so as to give them the appearance of rough calf." Dated April 15, 1859.

After the pelts have been tanned in the usual manner, the inventor puts them in frames and stains them, and while they are cool works them with a knife, and rubs them with pumice stone, and before dry he shaves them. When dry he again rubs them with pumice stone. *Patent abandoned.*

951. H. A. SILVER. "Improvements for insulating wire for electric telegraphs. Dated April 15, 1859.

Here the conducting wires are wound round with strips of india-rubber applied in one or more layers, and then subjected to the action of steam or heated air, by which the edges of the india-rubber become joined or cemented, and a complete coating is obtained to the conducting wires. *Patent completed.*

952. H. BARROW. "A new or improved fastening for fastening trunks, boxes, and articles of dress, and for such other purposes as the same is or may be applicable to." Dated April 16, 1859.

This fastening consists of two parts, one part being a knob, stud, or button, and the other part being an elastic disc or diaphragm having a hole in its middle smaller than the knob, &c., and in which hole the knob, &c., engages. *Patent completed.*

953. T. WHITE. "An improvement or improvements in frames or stands for holding liquor bottles, pickle jars, cruets and castors, and for holding bottles and vessels generally." Dated April 16, 1859.

Here the frames or stands are made in separate pieces which may be joined to a central piece having a handle so as to form a frame or stand of the ordinary kind. *Patent abandoned.*

954. J. GLASGOW and S. HAND. "An improved variable circular motion, applicable to slotting, shaping, and planing machines, or similar purposes," Dated April 16, 1859.

The patentees give motion to the main shaft of the machine by gearing or otherwise, and place upon one end a boss or plate having fixed to or cast with it a pin forming a crank, which pin works within the steel surfaced sides of another plate or boss fixed upon or cast to another shaft, the centre line of which is placed out of line or centre with the first mentioned shaft, so that it may receive variable motion, which being transmitted to tools of different descriptions enables them to employ a slow and powerful motion during the process of cutting, and give the return stroke with greater velocity. *Patent completed.*

955. L. COLLIER. "An improved feeding apparatus, applicable to grain, loaf-sugar, drugs, or other similar materials." Dated April 16, 1859.

Here the material passes into a hopper and falls at the lower part upon an endless feeding band, the motion of which carries the material out of the hopper in any desired quantity, its adjustment being determined by a sliding door or valve having a regulating screw and nuts. There are other features included. *Patent abandoned.*

956. W. CLARK. "Improvements in apparatus for separating metals from their ores and other matters." (A communication.) Dated April 16, 1859.

This invention is not described apart from the drawings. *Patent completed.*

957. W. E. NEWTON. "Improvements in the manufacture of alumina." (A communication.) Dated April 16, 1859.

This consists in processes to be employed in precipitating alumina either pure or in combination with other substances from its solutions in alkalies in the state of aluminate of soda or potash. The processes adopted by the patentee are described at very great length in his final specification. *Patent completed.*

958. J. HAMILTON. "Improvements in apparatus for regulating prime movers driven by water." Dated April 16, 1859.

Here the supply of water is not interfered with, the governor being arranged to put in action a brake or other retarding appliance which absorbs any surplus power, and thereby prevents such power from increasing the speed of the machinery. *Patent completed.*

959. A. COURAGE. "An improved method of obtaining the metallic particles contained in fumes or vapours from lead and other smelting works." Dated April 16, 1859.

This consists in the introduction of steam into the flue or flues communicating with the various furnaces, which, mixing with the fumes, causes the deposit therefrom of the metallic particles contained therein or therewith. The patentee prefers to use for the generation of the steam boilers or tanks placed in convenient positions in the flue or flues, and to utilise the waste heat therein to generate the steam; but steam generated in a boiler placed in any other convenient position may be introduced into the flues. *Patent completed.*

960. H. HARRISON. "Certain improvements in looms for weaving." Dated April 16, 1859.

This consists in making the taking-up rollers of sheet metal. The patentee prefers to use a sheet iron shell attached to cast iron discs or ends fixed to a shaft or furnished with trunnions. The shell after being varnished is covered with emery in the usual way. *Patent completed.*

961. J. SIDEBOTTOM. "Improvements in the construction of tubes and partial tubes, and in machinery or apparatus for placing them on the spindles of machines used in spinning, doubling, winding, and warping; also, improvements in machinery for making such tubes and partial tubes." Dated April 16, 1859.

This consists in applying to slit tubes or partial tube projections to facilitate the operation of placing them on to the spindles of machines with which they are used. The object of these tubes is to keep the hole in the cop perfectly open when the cops are removed from the spindles, and until they are placed on the skewers of the shuttles or winding machines, so that the yarn can be wound off without, or nearly without, waste. The patentee also makes tubes of suitable metal or material with a slit made in each of them lengthwise without applying thereto the projections above described. These tubes may be placed upon the spindles in the usual way, and by means of their elasticity will readily adapt themselves to the spindles, though their diameters may be somewhat too small, as occasionally happens. *Patent completed.*

962. H. H. VIVIAN. "Improvements in smelting copper." Dated April 16, 1859.

Here the inventor calcines the ore in the first instance so far that when smelted it will produce with regulus similar to that usually produced after two calcinings and two smeltings, and containing say 70 per cent. of copper, and the slag produced in this smelting process which will be rich in copper he smelts in a blast furnace, by which he obtains from it a further quantity of regulus and a clean and more uniform slag. He employs as fuel in the blast furnace either wholly or in part the coal and cinders which fall through the bars of the calcining and smelting furnaces. He also employs the blast furnace to reduce the red or coppery slags resulting from processes of copper smelting which are subsequent to the production of regulus. *Patent abandoned.*

963. N. KENWARD. "Improvements in machinery for obtaining motive power by fluids." Dated April 16, 1859.

Here two or more cylinders are arranged around a shaft or axis turning in suitable bearings. The shaft or axis passes through the cover or ends of the cylinder at a distance from the centre of each, so that the cylinders are excentric to the shaft or axis. Each of the cylinders is divided longitudinally into two compartments by a partition or piston fixed to the shaft or axis. Water or other fluid is supplied through the shaft or axis into each of the cylinders to one side only of the pistons or partitions therein. As the water or other fluid in the several cylinders is constantly pressing on the larger leverage of the partitions or pistons there is a tendency to cause them with their axis to rotate. *Patent abandoned.*

964. G. B. CORNISH. "Improvements applicable to fog-horns." Dated April 16, 1859.

This consists in applying to fog horns to be used at sea, a pair of hand bellows similar in construction to those now in common use for domestic purposes. *Patent abandoned.*

965. W. WALKER. "Improvements in rocket guns." (A communication.) Dated April 16, 1859.

This consists in constructing rocket-guns with the rear of the breech-end closed, and in allowing the back-fire of the rocket to escape through an opening or openings on the top of the barrel in place of the rear as now practised, and in fitting to the fore end or muzzle of the barrel a jointed curtain or flanch of, say, about 14 inches in diameter, which is hinged so as to be let down across the muzzle of the gun during the time of taking aim, but which rises up as the rocket leaves the gun and effectually prevents the back fire of the rocket from acting on the rear of the curtain or flange. *Patent abandoned.*

966. J. MOULE. "A new compound for illuminating purposes." Dated April 16, 1859.

This consists in mixing alcohol with turpentine or other hydrocarbons so as to form a liquid suitable for illuminating purposes. *Patent abandoned.*

967. J. LUIS. "An improved machine for raising water" (A communication.) Dated April 18, 1859.

This invention is not described apart from the drawings. *Patent completed.*

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968. R. WARRY. "Improvements in breech-loading ordnance and its projectiles." Dated April 18, 1859.

This consists, 1, in attaching to one end of a hollow cylinder a detachable breach, provided in the inside with a roller or stop, and by turning this roller or stop about a quarter part round, the cartridge is cut, the breech hole is closed, the nipple is primed, and the piece of ordnance is fired. 2. In applying to the outside part of any projectile a thread or screw which can be either cast in the making of such projectile, or can be turned on after the projectile is made. By this method the outside screwed face or projectile can be easily coated with any soft metal for firing from rifled or other cannon. *Patent abandoned.*

969. W. PROSSER. "Improvements in apparatus employed in the production of light." Dated April 18, 1859.

This refers to apparatus used in the production of light by the combustion of oxygen and hydrogen gases on lime, &c., and consists in arranging and securing the lime, &c., in a suitable case, parts of which are cut away to expose the lime, &c., to the action of the jet or jets of flame by which the lime, &c., is held together and moved as one piece. *Patent abandoned.*

970. G. PORTER. "Improvements in valves or cocks." Dated April 18, 1859.

This cock is formed in two halves—the inlet end and outlet—which are bolted or screwed together with an interposed plate in which there is an opening corresponding to the water-way through the cock; at the back of this interposed plate there is a sliding valve, which being moved up or down opens or closes the water passage. A pin affixed to the sliding valve takes into a vertical slide-rod, to which motion may be given by a lever screw or otherwise. The pressure of the fluid behind the slide-valve keeps it in close contact with the face plates, while a very small amount of force moves and opens or closes the passage. *Patent abandoned.*

971. J. WHITAKER. "Improvements in mowing machines." Dated April 18, 1859.

The patentee causes the bearings or castors of the guide wheels to be moveable so that they may be widened or contracted as desired. The said bearings or castors are placed upon the front rail of the machine, and held fast by set screws, nuts, or wedges. *Patent completed.*

972. J. SEAMAN. "Improvements in agricultural implements for working or cultivating the soil." Dated April 18, 1859.

The patentee constructs the beam of his improved plough of two flat bars put together with spreaders or struts, one of such struts being passed through the front part of the plough frame, and the bars left wide enough apart to admit of the point of the frame being adjusted to the right or to the left in order to set the head of the plough more or less to land as required. To facilitate this lateral adjustment the hind part of the frame is furnished with an upright pivot or bolt, and the tail of the beam has a vertical slotted or split mortice made therein, corresponding with the upright pivot on the hind part of the frame, and through which the pivot passes. This arrangement also admits of the head of the plough being set to any required height. The invention further relates to harrows, and consists in fitting the teeth on to the sides of the beams, and in securing them by bolts extending completely across the harrow, and passing through the heads of the teeth, and through the several beams horizontally. Tubular stretchers are placed on the bolts between the beams for forming the proper width of the harrow, and for enabling the whole to be screwed up firmly together by nuts at the outer ends of the bolts. The invention comprises other features which we cannot allude to in detail. *Patent completed.*

973. M. A. F. MENNONS. "An improved disinfecting compound." (A communication.) Dated April 18, 1859.

This compound is composed by adding 20lbs. of nitric acid to 1 cwt. of sawdust obtained from some light resinous wood, which after being well stirred has 5 oz. of essence of lavender, 5 oz. of essence of rosemary, 5 oz. of essence of spikenard added to it. A quantity of extract produced by the maceration and pressure of about 1 lb. each of orange and lemonpeel, is then added with about 25lbs. weight of fine dried sand, and the whole is thoroughly incorporated. *Patent abandoned.*

974. J. C. WILSON. "A reversible shawl cloak." Dated April 18, 1859.

This garment exhibits the appearance of a shawl on one side and a cloak on the other side. *Patent abandoned.*

975. J. IZOD. "A safety cigar, vesuvian, or fusee box or case." Dated April 18, 1859.

This consists in the introduction of a spring made of india-rubber to cause the closing of the box or case after it has been opened or used. *Patent abandoned.*

976. W. E. GEDGE. "An improved safety apparatus for clearing off condensed steam from steam-engines." Dated April 18, 1859.

The inventor places his apparatus beneath the cylinders of steam-engines, and adapts it wherever steam is susceptible of condensation. He leads the water produced by the condensation of the steam in the cylinder or elsewhere through a tube to the centre of a tap, and from thence through another tube to a reservoir; this reservoir is connected by a double lever to a balance weight, and where the water from the condensed steam shall more than one third fill the reservoir, the balance weight lifts and brings a tube leading from the bottom of the reservoir into connection with the centre of the tap, at the same time cutting off the connection of the centre of the tap with the first-mentioned tube, and from thence the water runs off through an escape pipe. When the reservoir shall thus have been drained to within one-third of its contents, the balance weight falls and restores it to its original position, at the same time bringing the first-mentioned tube again in connection with the centre of the tap, and consequently with the reservoir, and cutting off all communication between the lower tube and the escape pipe. *Patent abandoned.*

977. J. FREER. "Improvements in machines for planting grain and seed, and an improved seed feeder and meter for planting machines." Dated April 18, 1859.

This invention is not described apart from the drawings. *Patent completed.*

978. J. and H. S. MORTON. "Improvements in hearth-plates or ash-pans." Dated April 18, 1859.

The inventors propose to introduce a peculiar arrangement whereby alternate bars, radiating or parallel, in the upper part or face of the hearth plate or ashpan may be opened or closed at pleasure to admit of the ashes falling between them. *Patent abandoned.*

979. A. DALRYMPLE. "Improvements in the mode of covering crinoline, and in machines used in connection therewith." Dated April 18, 1859.

The inventor weaves the covering material first, and applies it to the crinoline by means of a machine consisting of a drum or reel, a pair of rolls, an overlapping guide or feeder, and boxes for containing the covering material, and an adhesive composition through which the crinoline passes. *Patent abandoned.*

980. G. COLLER. "An improved mowing machine." Dated April 18, 1859.

The inventor employs a framing mounted on wheels, the front wheel of which is connected to a large toothed wheel which communicates with other multiplying wheels, the last of which communicates with a cross shaft having a universal joint in its centre; the other end of the shaft is fitted with two grooved eccentrics, over which bands are passed connected to a chain moving round a vertical roller. A scythe is affixed to the bottom of the rollers; consequently as the machine moves forward motion is communicated from the driving wheel in front to the scythe roller behind, the scythe moving precisely the same as if in the hands of a mower. *Patent abandoned.*

981. F. and W. EDWARDS. "Improvements in looms for weaving ribbons and other like goods." Dated April 18, 1859.

This relates to the working of shuttles in ordinary narrow fabric looms where two or more sets of shuttles are used, and consists in the use of treddles so constructed that they can be brought in contact with levers communicating motion to the shuttles, the treddles being worked by two tappets on the tappet shaft. These treddles are connected with a lever that is worked by a cam on the tappet shaft which gives an oscillating motion to the treddles, which motion connects and disconnects them with the levers connected with the shuttles. The shuttle levers are worked in joints, and are brought in contact with the treddles by taper slide propellers, which are connected with the jacquard machine. As the machine rises, so the action is communicated to the propellers; the cards of the machine cause the propellers to rise, and by doing so bring the shuttle lever in contact with the treddles, and the lever is borne down by the treddles, thus taking the shuttles connected with that lever through the warps. By the sliding of the propellers motion is given to any set of shuttles. *Patent completed.*

982. W. PARSONS. "Improvements in preparing sheet iron, and other metal sheets, for japanners and other uses." Dated April 18, 1859.

This consists in tinning each of the edges of a plate or sheet, and then varnishing or coating the actual portion of each sheet or plate with a suitable varnish to prevent oxidation, by which on the one hand the sheets or plates readily admit of being soldered at the edges, and at the same time much tin will be saved. *Patent completed.*

983. J. BOYDELL. "Improvements in the apparatus applied to the wheels of locomotive, traction, and other carriages, to facilitate the draught." Dated April 18, 1859.

This has reference to two previous patents of the patentee, dated respectively 29th August, 1848, and 22nd February, 1854, and consists in making each bearing plate or surface with a portion of a rail thereon, one end of such rail projecting beyond the central portion of the bearing plate, but the sides of the same end of the bearing plate or surface project as far as or further than the end of the rail, so as to receive the opposite or back end of the next bearing plate or surface between the two front projecting portions of the sides of the bearing plate, which for the time is under the wheel; such hinder end of the next bearing plate or surface is formed with two projections, which, on taking the ground, come on either side of the portion of rail which projects beyond the central portion of the previous bearing plate. The portion of rail which is fixed on each bearing plate or surface only comes to the point at the back end of the bearing plate or surface where the portions which project commence or extend beyond the main surface of the bearing plate. There are in this arrangement two sets of guide plates, one set on each side of a wheel, and there are also two sets of what are called triangular bars, which work through the guide plates; two sides of each of these triangles are formed with curved or cycloidal bars, such as now applied to the inventor's traction engines, and they are attached to their bearing plates or surfaces so as to be capable of moving somewhat to and fro, and in the present arrangement these bars are used, and connected together in pairs at their upper ends, so that in rocking to and fro both go together. *Patent abandoned.*

984. W. GOSLING. "Improved rifle cannon and projectiles." Dated April 19, 1859.

This invention was described and illustrated at page 316, No. 20, Vol. 1 of the MECHANICS' MAGAZINE, (New Series). *Patent abandoned.*

985. P. and J. REYNOLDS. "Improvements in machinery or apparatus for hackling flax and other fibrous materials." Dated April 19, 1859.

This relates, 1, to mechanism for splitting, dividing, or cutting longitudinally the fibres of flax, hemp, &c., by means of hackles secured to moveable detached sliding bars projected by springs, buffers, cams, tappets, or levers, into the fibrous substances, causing the hackle pins to penetrate the fibres instantaneously, and close below the holders. It relates, 2, to all hackling machines in which the strick holders are made to descend and ascend, and it consists in the application of clips, buffers, or rollers for holding the ends of the stricks of fibrous material steady when being operated upon by the hackles. It further relates to all hackling machines in which the strick holders are raised up and down, and traversed from one end of the machine to the other, and it comprises an improved combination of wheels and levers to produce the desired motion. *Patent completed.*

986. C. BATTY. "An improved means or apparatus for effecting instantaneous communication on railways between passengers and officials." Dated April 19, 1859.

This consists in the use of any description of polished reflector fixed at each side of the engine, or other part of the train, and so placed that the engine-driver or guard may detect any irregularity or accident, or passengers' signals occurring in any part of the train, by the reflection in the said mirrors. *Patent completed.*

987. I. DUTTON, R. MARTIN, and T. PHILLIPS. "New or improved machinery for preventing accidents in coal or other mines, by the drawing of skips or cages over their pulleys." Dated April 19, 1859.

The object of this invention is accomplished by means of machinery, consisting essentially of a screw on which a wheel is made to advance by the rotation of the drum shaft of the mine engine, which said wheel having advanced to a certain distance in either direction upon the said screw, engages with a clutch, whereby an ordinary break attached to the engine is brought into operation, and the engine stopped. *Patent completed.*

988. A. W. WILLIAMSON. "Improvements in making extracts from liquorice root." Dated April 19, 1859.

Here the inventor boils the spent roots (*i. e.* the roots extracted by water) with a dilute solution of

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caustic alkali for two or three hours, and evaporates the solution thus obtained, together with the one previously prepared by the use of water alone. *Patent completed.*

989. O. MAGGS. "Improvements in cheese-presses." Dated April 19, 1859.

Here a press is made with a bed plate (on which the cheese is pressed), and it has two or more uprights which serve to guide the platten as it is raised or lowered by a screw. The two uprights are connected together by a cross-head, in the centre of which is a hollow socket for the reception of rings of vulcanized india-rubber. The nut in which the screw works is formed with a projecting flange at its lower end, on which are two descending guide-pins which pass through two holes in the lower part or plate of the hollow socket formed in the cross-head. On the flange around the nut one or more rings of vulcanized india-rubber is or are placed; and there is a shoulder within the hollow socket in the head of the press against which the upper ring of india-rubber presses. *Patent abandoned.*

990. J. W. MATTHEWS. "An improvement in the manufacture of hats and other coverings for the head." Dated April 19, 1859.

The inventor forms a felt body, and covers the same with the ordinary silk tissue. These substances he attaches together by suitable varnish or liquid cement. The hat is thus produced having the appearance and advantages of a beaver hat. *Patent abandoned.*

991. A. V. NEWTON. "Improved machinery for weaving seamless bags or other articles with hemispherical, or regular or irregular ends or forms." (A communication.) Dated April 19, 1859.

This consists of a combination of an ordinary jacquard harness and a tapering reed, which narrows from top to bottom, and between the wires of which the threads or yarns of the warp pass. *Patent completed.*

992. Q. BECK. "Improvements in stoves." (A communication.) Dated April 20, 1859.

The patentee claims, 1, constructing stoves with tops or covers capable of being revolved in order to expose pots, pans, and other vessels placed in apertures therein immediately over the fire, or to remove them to a part of the stove where they will be exposed to less heat. 2. Constructing the tops or covers of stoves of two thicknesses of metal, with space between the thicknesses. 3. The use of a rack and pinion fitted with a crank handle for communicating rotary motion to the cover. *Patent completed.*

993. J. WOTTON. "An improvement or improvements in raising or shaping metals." Dated April 20, 1859.

This consists in raising or shaping sheet metal into globular shaped vessels, by bending the sheet metal into a cylindrical or conical tube, and casting or inserting in the tube a support or lining of tin and lead, the tube being raised into a globular, or nearly globular, vessel by raising dies, the lining or support in the interior of the tube preventing the puckering of the edges of the metal during the raising process. *Patent completed.*

994. J. M. and E. JOHNSON. "Improvements in the production of ornamental surfaces suitable for advertisement tablets, plates for shop-fronts, and for other uses." Dated April 20, 1859.

The patentees claim the combining of a sheet of gelatine having a design produced on it in opaque colour or material with strips of coloured gelatine, and also with metal foil or paper as described. Also the mounting a sheet of gelatine having a design produced on it in combination with opaque strips of two or more colours as described. Also the substitution of sheets or strips of glass for sheets or strips of gelatine as described. *Patent completed.*

995. A. W. WILLIAMSON. "Improvements in obtaining extracts from the liquorice root." Dated April 20, 1859.

This consists in removing and excluding atmospheric air from the vessels in which the roots are boiled with water, and performing the subsequent evaporation of the extract in a vessel from which atmospheric air is similarly removed and excluded. *Patent completed.*

996. H. RAWSON. "Improvements in machinery for combing wool and other fibres." Dated April 20, 1859.

Here the wool, &c., to be combed is fed into the machine between feed rollers, and in front of the feeding head there are two combs; that nearest to the feeding head is a comb about equal in length to the width of the feeding head, and the other is a circular or endless comb. The first comb has a motion communicated to it to and from the circular or endless comb. When the two combs are in contact, the wool, &c., is laid on to them and pressed into their teeth by brushes. The first comb then moves away from the circular or endless comb, and the slivers are broken; cleaned fringes of fibre then project from both combs. The slivers are next lifted out of the first comb, which then again comes up to the circular or endless comb, and the slivers are again laid on the combs and pressed down, the cleaned ends of the fibres which before projected from the first comb being placed beyond the teeth of the circular or endless comb. These motions are constantly continued, and the circular or endless comb moves on to carry the fibre in its teeth to drawing rollers to be drawn off. A pair of drawing rollers first draws a sliver from the exterior of the circular or endless comb, and then another pair of drawing rollers draws a sliver from the interior thereof. A third pair of drawing rollers removes the wool from the circular or endless comb. *Patent completed.*

997. L. J. PORTER. "Improvements in knitting machinery." (A communication.) Dated April 20, 1859.

The object here is mainly to produce knitted fabrics of varying width, such, for example, as the sheets of fabric used to form the legs of knit drawers and the sleeves of knit shirts. The invention is applicable, however, to other knit fabrics, as, for example, those in which ornamental patterns are produced by the transference of stitches. The invention is divided into several parts, which we cannot allude to in detail. *Patent completed.*

998. J. APPERLY and W. CLISSOLD. "Improved apparatus for oiling wool." Dated April 20, 1859.

Here the inventors mount, immediately over the upper feed roll, an iron roller in which are sunk lines of shallow holes which form cups for receiving the oil. Above this roller they mount a series of short oil troughs, the bottoms of which are concaved to fit the roller upon which they bear, being supported in position by a suitable frame attached to the framing of the carding engine. The concaved bottoms of the trough are pierced with holes to permit of the oil issuing out and filling the rows of cups as they are severally brought under these holes by the continued rotation of the iron roller. The close fit of the troughs in the roller will effectually prevent the running of the oil, &c., when the engine is not at work, and limit the supply to the capacity of the cups. As, therefore, the iron roller revolves, it will discharge the oil from the cups on to the upper feed roller, which will deliver it in a thin film on to the surface of the wool as it passes into the carding engine. *Patent abandoned.*

999. A. F. VANHULST. "An improved kiln for drying malt." Dated April 21, 1859.

This consists of a hollow drying drum having its external surface made of metallic gauze or perforated sheet iron, the interior of such drum being divided into six or more perforated compartments each having one or more doors or openings therein. The driver is constructed upon two fly wheels, one being provided with a rack by which motion may be communicated thereto. The fly wheels are mounted upon an iron shaft and are connected together at their extremities by a suitable number of cross bars or tie rods. Upon the drum and fly wheel shaft are fixed two iron rings at a distance of about from one third to two thirds of its length (included between the fly wheels); into these iron rings are screwed a suitable number of radial arms or stays, which extend to, and are connected with, the cross bars which unite the fly wheels together. The drum thus arranged is mounted horizontally, and is put in motion by an endless screw or worm working in connection with the rack over a coke fire fitted at top with an iron framing covered with glazed tiles for receiving the malt which falls from the revolving drum, and for preventing an infectious smell to the beer. *Patent abandoned.*

1000. E. COTTAM. "Improvements in apparatus employed for cutting or sawing metals and other substances." Dated April 21, 1859.

This consists in attaching to the two ends of a saw or knife suitable guides, and connecting them by a band or rope of metal, so as with the said saw or knife to form one continued band, having due adjustment in some part of its length for giving to it any required degree of tension, and from which band the saw or knife receives a reciprocating movement. The band of metal may be caused either to pass over pulleys or segmental portions of pulleys, or may be formed of suitable lengths, and connected by levers or bell cranks mounted on a suitable frame, and may be actuated by a foot treadle, hand fly wheel, or otherwise. The lightness of the moveable parts of the apparatus admit of a rapid motion. *Patent abandoned.*

1001. T. DAWSON and J. AVERY. "Improvements in pencil-cases, watch seals and keys, toothpicks, and other like articles of jewellery, lockets, penknife handles, porte-monnaies, and other like articles." Dated April 21, 1859.

This consists in so constructing such articles, so as to allow space for a number of postage or receipt stamps, &c., to be wound in and out by a mechanical contrivance that shall have a propelling power regulated by the number of stamps to be wound in and out. *Patent abandoned.*

1002. J. NAPIER. "Improvements in producing figures or representations upon glass." Dated April 21, 1859.

This consists in using any ordinary print, lithograph, or engraving, or design drawn by hand with printer's ink, and producing a like figure, &c., on glass, by pasting the same on the glass and acting upon this with hydrofluoric acid. *Patent completed.*

1003. J. ALISON. "An improved instrument for extirpating thistles, docks, and other deep-rooted weeds." Dated April 21, 1859.

This consists of an upright stem, furnished at its upper end with a cross handle. At a short distance from its lower end, which is pointed, a steel cutter is inserted at right angles to the stem of the instrument. The edges of this cutter are twisted to an angle of about 37. On pushing the point of the instrument into the ground, where a thistle or weed is growing, and turning it round by the handle, the cutter penetrates the ground in a spiral direction, cutting the roots of the weed at each revolution, by which means it is effectually destroyed. *Patent completed.*

1004. J. DAVIES. "A new or improved apparatus for ringing door-bells, and a bolt to be used with the said apparatus, and for other purposes to which the said bolt is or may be applicable." Dated April 21, 1859.

This consists of two levers, between the lower ends of which the top of the closed door, or a bolt on the top of the door, is situated, the levers being so connected with the hammer of a bell that the hammer is made to strike the bell as the door opening in either direction escapes from the end of one or other of the levers. A bolt in which the handle or stem, whereby the bolt is worked, is so connected with the bolt by a spring, that the end of the handle or stem is made to enter holes in the bolt case when the bolt is either shot or withdrawn, and thereby fix the bolt, the liberation of the bolt being effected by putting forward the handle or stem of the bolt. *Patent completed.*

1005. D. AULD. "Improvements in machinery or apparatus for supplying steam-boilers with water." Dated April 21, 1859.

This relates to a previous patent dated 29th April, 1858. On the top of the boiler there is fitted up a vertical pillar standard, carrying at its upper end a horizontal stud for a vertically disposed chain pulley or wheel. Over the pulley is passed a short chain connected at one end to a hollow copper sphere, ball, or rising and falling chamber, and at the other end to a counterpoise weight, such weight being heavy enough to retain the hollow ball at the top of its rise when the latter is empty, but not sufficiently heavy to retain it up when full or nearly full of water. The ball is attached to the free ends of two parallel pipes, the other ends of which are connected to a cylindrical valve, chamber, or cock set on the top of the boiler, and having two pipes passing from it into the boiler, one terminating at or above, and the other below the working water level. The chain pulley has on one side of it a small pulley or cam-piece with one or more notches, inclines, or recesses in its periphery. Immediately below the centre-stud of the pulley there is a second horizontal stud in the pillar, to carry two horizontal reversed weighted levers having adjustable weights on their free ends, which are straight. The opposite or inner ends of these levers are considerably curved, and formed with terminal hooks or catches, being so set that their curved portions embrace a large portion of the notched pulley's diameter. *Patent completed.*

1006. R. A. BROOMAN. "Improvements in knitting frames." (A communication.) Dated April 21, 1859.

Here all the parts now forming knitting frames remain, but the motions thereof are produced mechanically, so as to make them self-acting. By a repetition of parts along a frame a great number of similar fabrics may be produced at one and the same time. The driving shaft runs along the front of the frame, and through bevil gearing, and an inclined connecting shaft motion is communicated to another shaft with excentrics, which are arranged upon it so as, upon the revolution of the shaft, to set in motion levers and cams, which in turn produce all the movements now effected by hand. *Patent abandoned.*

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PROVISIONAL PROTECTIONS.

Dated Sept. 13, 1859.

2132. H. J. Warlomont. Improvements in apparatus to be employed in the manufacture of zinc.

Dated Oct. 19, 1859.

2398. G. Gregg. An improved method of dyeing leather black.

Dated Oct. 27, 1859.

2458. P. R. Hodge. Improvements in the process of brewing fermented liquors, and in apparatus connected therewith, and in preparing and separating the materials, and the manner of using them in producing fermented liquors.

Dated Oct. 29, 1859.

2472. J. Mascord, J. Bonner, and F. Viner. Improved machinery or apparatus for cutting up and pulping or reducing vegetable and animal substances.

Dated Nov. 2, 1859.

2495. J. L. Budden. Improvements in forming and driving piles for the construction of piers, jetties, viaducts, bridges, or other works where piles are usually employed. (A communication.)

Dated Nov. 3, 1859.

2497. J. A. Turner. Improvements in rendering paper waterproof.

2499. I. F. Delavier. Improvements in coffee pots, tea pots, and other culinary or pharmaceutical vessels of the same nature.

2501. C. Bacon. Improvements in globes and shades for gas-lights, and oil or other lamps.

2503. C. W. Siemens. Improvements in insulating electric telegraphic conductors and in battery arrangements connected therewith. (Partly a communication.)

2505. G. Wemyss. Improvements in ventilators.

Dated Nov. 4, 1859.

2507. E. Juzet. Improvements in lubricating apparatus.

2509. A. P. Boothby. Improvements in travelling and such like bags.

2511. L. Koch. A moving tread power.

2513. C. Brook, jun. Improved arrangements and apparatus for folding, tieing, and labelling hanks of yarn or thread.

2515. W. Clarke and J. Gee. Improvements in the manufacture of looped fabrics.

2517. R. A. Brooman. Improvements in breech-loading ordnance and other fire-arms, and in projectiles to be used therewith. (A communication.)

Dated Nov. 5, 1859.

2521. D. Joy. Improvements in machinery for the manufacture of telegraphic cables. (A communication.)

2523. E. A. Cuche. Improvements in galvanizing metallic wires.

2525. T. W. McCallum and L. Woodward. Improvements in frame work knitting machinery.

Dated Nov. 7, 1859.

2527. P. Dietens. A system of letter-paper, letter-invoices, letter-circulars, prices-currents, memorandums, and other missives.

2529. J. A. Clarke. Improvements in extracting seeds or stones from fruit.

2531. H. Charlton. Certain improvements in the method of navigating steam ships or vessels, and in the apparatus connected therewith.

2533. G. Meline. Improvements in mills of whatever kind.

2535. W. E. Newton. Improvements in promoting or accelerating combustion in furnaces or fire-places. (A communication.)

Dated Nov. 8, 1859.

2537. H. B. Powell. The protection and prevention of fouling or injuring by foreign matters the screws, paddles, rudders, and stern posts of steam ships of other vessels.

2539. C. Green. Improvements in the manufacture of tubes suitable for locomotive and other steam-boilers.

2541. J. H. Johnson. Improvements in "passe-partouts," or mounts for pictures. (A communication.)

2543. G. Hadfield. Improved machinery for cutting staves for casks and barrels.

2545. W. Clark. A compound applicable for the manufacture of manure, the preservation and disinfection of organic matters, and for other purposes. (A communication.)

Dated Nov. 9, 1859.

2547. G. White. Improvements in the manufacture of endless leather bands, straps, or belts for driving machinery, and in apparatus for effecting the same. (A communication.)

2549. M. A. F. Mennons. An improved means of destroying insects in grain and other organic matters. (A communication.)

2551. J. Dales. Improvements in applying deodorizing fluids to sewers and other receptacles of sewage.

Dated Nov. 10, 1859.

2553. E. T. Hughes. Improvements in railway breaks, also applicable for arresting the rotary motion of wheels and cylindrical bodies in general. (A communication.)

2555. R. A. Brooman. Improvements in mills or apparatus for extracting oil from seeds, and for other purposes. (A communication.)

2557. A. J. Melhuish. Improvements in the construction of cameras for obtaining photographic pictures.

2559. G. Seymour. Improvements in insulating and protecting electric telegraph conductors.

2561. W. Day. Certain improvements in propelling vessels, which said invention is also applicable for converting the force of the wind into a motive power to be used in any convenient way either for stationary or moveable purposes.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

2574. M. A. F. Mennons. Improved apparatuses for the concentration, distribution, and application of the heat evolved by gas, oil, and other lamps. (A communication.) Dated Nov. 14, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Nov.* 22, 1859.)

1657. C. S. Walker and R. Hoyle. Furnaces and boilers.
1662. J. Taylor. Stoves and fire places.
1666. J. Atkinson. Fire-arms.
1671. C. Kingsford. Fuel.
1672. W. Clark and W. Williams. Woven fabrics.
1676. J. P. Farrar. Iron.
1684. H. Cunnew. Elastic bands.
1686. O'D. Grimshaw. Letter boxes.
1689. T. Carlisle. Vent pegs.
1692. H. C. M. Cramer. Bedsteads.
1697. A. V. Newton. India-rubber fabrics. (A communication.)
1700. J. Shanks. Mowing machines.
1702. J. C. Riddel. Stalls, loose-boxes, &c.
1703. J. Erskine. Fire arms.
1704. T. Curtis and J. Haigh. Finishing cloths.
1723. H. N. Harrop, jun. Cigar lighter.
1728. J. Rowland, jun. Sizing yarns.
1735. J. H. Johnson. Slide valves. (A communication.)
1758. I. M. Lindley. Cop tubes.
1764. A. V. Newton. Revolvers and bullets. (A communication.)
1781. W. E. Newton. Salinometer cases. (A communication.)
1786. B. Donkin. Valves. (A communication.)
1818. A. F. Delannoy. Lubricating.
1823. L. B. Ollivier. Stoppering bottles.
1834. N. Kenward. Tubular steam boilers.
1989. R. A. Brooman. Treating ores. (A communication.)
2021. R. K. Goddard. Making infusions.
2084. W. B. Adams. Permanent way.
2116. J. Lais. Automaton bell. (A communication.)
2138. P. J. L. Chauriont. Fire-arms.
2282. W. E. Newton. Spinning. (A communication.)
2283. W. E. Newton. Combs or gills. (A communication.)
2285. A. Scheurer-Kott. Fixing colors in dyeing and printing.
2349. J. Gordon. Pulping coffee.
2413. J. Avery. Platform scales. (A communication.)
2436. W. C. Day. Stockings and drawers.
2442. A. McGlashan. Refrigerators.
2480. J. Ingham and G. Collier. Weavings.
2495. J. L. Budden. Piles. (A communication.)
2503. G. Wemyss. Ventilators.
2511. L. Koch. Moving tread power.
2531. H. Charlton. Navigating vessels.
2561. W. Day. Propelling vessels.
2574. M. A. F. Mennons. Heating. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Nov. 18, 1859.

1243. H. Newman.
1250. J. P. Budd.
1253. J. R. Scartliff.
1340. J. F. Miquel.
1402. W. Burness.
1511. E. T. Hughes.

Sealed Nov. 22, 1859.

1261. J. Knowles.
1282. R. V. Leach and T. W. Willett.
1284. G. Burnell.
1288. C. P. Moody.
1289. R. A. Brooman.
1277. G. Davies.
1270. G. D. Jones.
1280. J. Gibbs.
1284. A. J. Sax.
1292. A. Prince.
1300. H. W. Patrick.
1304. G. F. Chantrell.
1314. L. Farrenc and B. Subia.
1316. G. Hadfield.
1328. J. Bruce.
1333. W. Green.
1344. G. H. Smith.
1346. J. J. Lundy.
1368. J. H. Johnson.
1406. T. Greensmields.
1450. T. W. Jones.
1756. P. Robertson.
1843. F. L. Lawrence.
1958. E. Rettig.
1970. J. H. Johnson.
1978. J. Cowgill and J. Stocks.
2044. A. V. Newton.
2072. M. A. F. Mennons.
2104. J. P. Clarke.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2705. G. Davies.
2717. E. Blanchon.
2741. S. Fox.
2743. J. M. Gilbert.
2757. J. W. Clare.
2758. C. Tooth.
2797. J. Marshall, jun.
2815. J. Higgin.
2818. J. M. Saunders.
2858. M. Townsend.
2894. W. H. Bowers.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

767. J. Ramsbottom.
771. J. T. Way and J. M. Paine.
780. J. Potter.
785. P. Carmichael.

LIST OF SPECIFICATIONS, &c.

Published during the week ending Nov. 25, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
900	0 3	913	0 3	925	0 3	937	0 6	949	0 3	961	0 10
901	0 3	914	0 3	926	0 7	938	0 3	950	0 7	962	0 3
902	0 3	915	0 3	927	0 3	939	0 10	951	0 3	963	0 6
903	0 3	916	0 5	928	0 3	940	0 6	952	0 5	964	0 10
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905	0 6	918	0 6	930	0 7	942	0 3	954	0 6	966	0 3
906	0 6	919	0 10	931	0 3	943	0 7	955	0 3	967	0 3
907	0 7	920	0 3	932	0 6	944	0 3	956	0 6	968	0 3
908	0 3	921	0 8	933	0 4	945	0 5	957	0 3	[illegible]	
911	0 9	922	0 3	934	0 10	946	0 4	958	0 6	[illegible]	
912	0 5	925	0 8	935	0 6	946	0 7	959	0 5	[illegible]	

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Designs.
Oct. 28,	4208	J. Muirhead, Regent's-park	Battery.
Nov. 3,	4209	J. S. Margetson, Cheapside	Wristband.
,, 5,	4210	J. Medwin, Regent-st.	Boot.
,, 7,	4211	G. P. Evelyn, Brompton	[illegible]
,, 14,	4212	E. and A. Ludlow, Birmingham	Cartridge carrier.
,, 16,	4213	S. and T. Carrington, Stockport	Rim for hats.
,, 19,	4214	C. H. Farrer, Wigton	Liquid distributor.
,, 23,	4215	Bowley & Co., Charing-Cross	Knee-cap.

PROVISIONAL REGISTRATIONS.

Nov. 14,	1115	W. Vincent, Dublin	Ventilator.
,, 15,	1116	J. B. Bowlay, Dodbrooke	Plough.
,, 17,	1117	C. Speed, Exton	Corn guard
,, 18,	1118	H. J. & D. Nicoll, Regent-street	Stud and buttee combined.
,, 19,	1119	E. S. Brooks, Lenton Sands	Shutters.
,, 21,	1120	J. S. Cooke, Colchester	Distance gauge.
,, 23,	1121	J. M. O. Reilly, Upper Rathmines	Lamp.
,, 23,	1122	Bowley & Co., Charing-Cross	Knee-cap.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 2, 1859.

THE TRAINING OF SHIPWRIGHT OFFICERS.

THE Admiralty have at various times attempted to train superior shipwright officers for the Royal dockyards. The School of Naval Architecture, in which the present assistants to the Surveyor of the Navy and most of the present master shipwrights were trained, was their great effort. Nor, notwithstanding Sir James Graham's animus against it, was it by any means an unsuccessful one. The School of Naval Architecture for the first time taught the Government—and many others beside the Government—that it was possible for efficient shipwright officers to be gentlemen. It did not, of course, make every man who passed through it a genius, or even a clever mechanic; no system of education will ever do that. But it produced several men of eminent ability in their profession, and it made most of those who were trained in it men of taste and culture. It was to one of its members, Mr. Abethell, that Her Majesty, at the launch of the Victoria a few days since, showed marked consideration by repeated acts of grace and favour. All who studied in this school had to encounter opposition and to sustain neglect; but they, for the most part, met the first with firmness, and bore the latter with dignity. If we contrast the present race of master shipwrights with master shipwrights of what was called the "old "school"—good "practical" men—we have indeed reason to be thankful for the School of Naval Architecture! The writings of Mr. Abethell, Mr. Chatfield, Mr. Read, Mr. Creuze, and other members of the school, in the "Papers "on Naval Architecture" and elsewhere, sufficiently attest the fact that with the qualities of gentlemen they combined an amount of professional ability never before attained by any class of shipbuilders in this, or indeed in any, country.

After the School of Naval Architecture had been abolished some years, a new school having similar objects placed before it was established —about 1848. It was at first intended that this should be named the "Central Mathema- "tical School," but the more fitting designation of "School of Mathematics and Naval Con- "struction" was given it on its establishment. The latter name is that by which it is officially known, although the Committee on Dockyard Economy, for a reason which may easily be conceived, used the former throughout their inquiries. The pupils for this school were selected by competitive examination from among the most promising apprentices of Her Majesty's dockyards, and the Admiralty were so fortunate as to secure as a Principal for it the Rev. Joseph Woolley, LL.D., F.R.A.S., formerly Fellow of St. John's College, Cambridge, now one of Her Majesty's Inspectors of Schools. The improvements which this gentleman has introduced into the modes of calculation adopted by naval architects—the writings on naval architecture which have proceeded from his pen—the high professional attainments with which several of his pupils came forth from the school—all these prove that the Rev. Dr. Woolley brought to his office precisely that combination of ability, energy, and teaching-power (if we may so speak) which was so necessary in an institution of this kind. The pupils entered the school with a knowledge of Euclid, Algebra, and some other subjects ranging with these in scientific studies; and while there, steadily went through Plane and Spherical Trigonometry, Hydrostatics and Hydrodynamics, Theory of Equations, Co-ordinate and Descriptive Geometry (the latter being a most valuable subject of study, which Dr. Woolley may be said to have almost introduced into English science), the Differential and Integral Calculus, Differential Equations, Snowball's and other works on Mechanics, Moseley's "Engi- "neering and Architecture," all that is known (both published and in manuscript) of the Theory of Naval Architecture, Theory of the Steam Engine, Chemistry, and some other subjects; and the course of study was so conducted by the Principal that, as the students advanced, the light of each new subject was thrown, wherever practicable, upon the profession for which they were in training. In order that the general education of the young men might not be neglected, the Rev. Dr. Woolley taught all of them at least one foreign language, and some of them as many as three such languages; and likewise caused the whole of them to study, and pass examinations in, Jewish History, Logic, Mental Philosophy, Paley's "Evidences of Christianity," Butler's "Analogy," and Pearson on the Creed. One-half of their day time was also bestowed upon actual shipbuilding and laying-off. Such were the studies pursued by the members of the School of Mathematics and Naval Construction, which school, like the former, perished at the hands of Sir James Graham.

Now, one part of the business—a voluntary part, it should be observed—of the recent Committee on Dockyard Economy was to suggest some means of fulfilling the object with which these abolished schools were established, viz., that of providing a class of persons to whom the superior offices of the dockyards might be fitly committed. As a matter of decency, before recommending a scheme of their own, they felt bound to inquire into the nature and effects of the training imparted at the school which was in existence seven years ago. In doing this they subjected but one of the late members of the school to an examination, although there were several others who might readily have enlightened such men as Mr. Bowman, Mr. Murray, and Mr. Laws. Mr. William Owen, an Inspector of Shipwrights in Chatham Dockyard, was the officer selected for interrogation, and, if we are not mistaken, his answers display much better sense than the questions which were put to him. For—will it be believed?—some of these brilliant Committee-men gravely inquired of Mr. Owen who made his bed at Portsmouth? who cleaned his boots? who cooked his dinner? and who carried it to him when it was cooked? Indeed, one of them, after the rest of the Committee had turned from these to weightier matters, actually broke in upon a series of professional inquiries to ask the witness—first, who cleaned the college knives and forks? and, secondly, who did his washing? Will Mr. Murray kindly inform us whether it was or was not Mr. Bowman who put these questions? When the Committee put away childish things, and made sensible inquiries, Mr. Owen acquitted himself in a manner which deserves commendation, and gave a pretty correct account of the studies pursued in the School of Mathematics and Naval Construction.

The opinions which the most enlightened of shipwright officers of the dockyards expressed to the Committee respecting the late school were, it seems to us, even more favourable than could have been anticipated. For it is not an easy thing to estimate the merits of young men impartially, especially when they have undergone a special training. We are apt to expect too much of them, and to forget what they would have been if left untrained. We are apt, moreover, to exaggerate the defects which we see in them, and to lose sight of the merits which they have no opportunity of displaying. This is particularly true in the case under notice, for up to the present moment not one of the young men trained in the late school has ever yet been examined in the sciences which they spent most of their time upon at Portsmouth. The Surveyor of the Navy has never given them the slightest chance of exhibiting their higher qualifications, but has kept them strictly to competitions in which higher studies have played no part whatever. When we add to these facts the further one, that it is impossible for young men to acquire the higher education of the naval architect without being injured somewhat, for a time, in respect of his practical skill, it would not have been surprising had the dockyard officers generally formed a low estimate of the value of the training which the members of the late school underwent. This very thing happened, as is well known, in reference to the first Portsmouth School—the School of Naval Architecture—and its members endured much undeserved neglect in consequence of it. But we find, as we have intimated, that a favourable view of the members of the late school is entertained by the principal officers of the dockyard. Mr. Abethell, the first Master Shipwright examined by the Committee, states that he thinks the continuance of the late school was desirable in the absence of any other institution for training professional officers. "I think," he says, "its "continuance would have held out good pro- "mise to the service, as far as a supply of scien- "tifically educated officers is concerned." Mr. Cradock, the first Assistant-Master Shipwright examined by them (now Master Shipwright of Pembroke dockyard), stated that there are young men from the school who have shown that their superior education tends to the advantage of the service; and when asked if he considered there were instances of young men educated at the school whose attainments would qualify them for being raised to the rank of master shipwrights, he answered, "I think that "there are, including those who have left the "service; and even without them." Even Mr. Moody, who never had the advantage of a special training himself, and who (therefore) prides himself on being an eminently practical officer, goes so far as to say in reference to the members of the late school, "Out of nine whom I "know, there are three fully competent to fulfil "their duties in their present positions;" and that "there is no doubt of the mathematical "attainments" of the pupils generally. The opinions of these three gentlemen may be taken as fair examples of the prevalent views of dockyard officers. We may add to them the fact that three of the members of the school have been employed for several years in the Surveyor of the Navy's department, and that they there perform duties which demand the very highest qualifications of the naval architect.

Despite all adverse influences, therefore, the late School of Mathematics and Naval Construction answered its end satisfactorily, by giving to the service a class of men fit, for the most part, to rise to the superior offices of the dockyards. In the hands of most men it might have proved a failure; and its success was doubtless due to the distinguished ability of Dr. Woolley, its Principal. Had the practical part of the pupils' education been as well attended to by the gentleman who had the responsible charge of it (and who is too old and too afflicted to be mentioned here), there would have been no room left for censure, or even for cavil, of any

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kind. The men who passed through it have but to be patient, and they will doubtless rise in time to the highest posts in the service.

In a future article we shall consider the scheme proposed by the Committee of Economy for the training of professional officers.

THE INSTITUTION OF ENGINEERS IN SCOTLAND.

WHEN our eyes light on an admirable youth, full of various faculty and energy, we naturally desire that the best may be made of him—that all his manly attributes may be fully and harmoniously developed. We should grieve to see his reasoning powers over-fostered till he lost all fancy, or his imagination cherished at the expense of his intelligence, or his passions indulged in to the injury of his morals, or his moral nature strained to the detriment of his freedom, or any one part of him duly expanded at the sacrifice of the others. The fact of his existence with a certain set of special capabilities is of itself sufficient to assure us that there is special work, which requires all his endowments, for him to do; and it is this special work which we desire to see him prepare for, and set about. And as with a man, so with an Institution. When we see a Society established with a unique name and novel functions, we can have no pleasure in it unless it performs unique and novel duties, and this with the full force of all its various powers.

We have been led into these reflections by an examination of the second volume of the Transactions of the Institution of Engineers in Scotland. When we hailed the first appearance of this body in 1857, we understood that its objects were in no way inferior to those of similar bodies in England; and these we know are not merely to edify the engineers of a single town, or a few towns only; but first to bring together into a centre, and thence to disperse over the world, professional information which would otherwise be inaccessible to all but a few. The Institution of Civil Engineers and the Institution of Mechanical Engineers most assuredly do this; and we did hope that the Institution of Engineers in Scotland would do the same. The volume before us, however, valuable as it is—for it is valuable—has lowered our expectations of what the latter body is destined to do for us. We begin rather to fear that this youthful Institution, in which we saw so much promise, is getting unduly developed in some of its parts. Its printing and publishing faculty is expanding wonderfully. It has here produced more than 150 pages of matter in beautiful type and on excellent paper, with twelve lithographic plates of considerable beauty, and thirty pages of the most exquisitely printed tables that the eyes of ordinary readers ever perhaps beheld. But, on the other hand, the Society's power of producing valuable professional papers seems to have been unhappily neglected. Scottish engineering seems rather a barren field in this respect. We look in vain into the volume for any considerable display of Scotch engineering works, like that with which the two English Institutions before-mentioned supply us. We have descriptions of Professor Thomson's centrifugal pump, Mr. Bell's ship docks, Mr. Carmichael's steam experiments, a smoke-preventing apparatus or two, Messrs. Napier and Sons' experiments on steel and wrought iron, a note on certain chemical furnaces, and a couple of theoretical papers by Professor Rankine and Mr. Lawrie. This includes, if we mistake not, all the novelties which are the subjects of papers, if we except Mr. Hunt's on Patent Law Reform, which can hardly be deemed an engineering document. We have, it is true, other things described, such as Mr. Beattie's coal-burning locomotive, the furnaces of Mr. Williams, Mr. Yarrow, Mr. Clark, &c., and other inventions which have been described over and over again in publications; we have also the reports of several more or less desultory discussions in which other improvements are mentioned. But we think it is perfectly fair to say, that the whole second annual session of the Institution produced no more than half-a-dozen good original professional papers from all the engineers of Scotland.

Now, we know something of the difficulties of young societies, and we should be sorry indeed to speak hostilely of the Institution now under consideration. But we must faithfully remind our Scotch friends that they are doing less at present than will speedily be expected of them. The name of their body is dignified, and itself challenges comparisons with other bodies. That which would be accepted, therefore, as ample from a local Institution, will be held meagre coming from them. And it will not do for its managers to forget this. If the volume before us bore the title—"Transactions of the Glasgow Institution of Engineers," it would be deemed a most creditable production. But of the engineers of Scotland more is expected. It is in all friendliness that we tell them so; and we trust their next volume will prove that a word to the Scotch is enough.

THE COMPASSES OF IRON SHIPS.

IN pursuing our review of the Liverpool Compass Committee's Report on this subject, we come next to the changeable portions of the ship's magnetism, the *vertical inductive* and the *horizontal inductive*—the latter being now very frequently termed a ship's quadrantal magnetism, from the change in the direction of the deviation due to it in each quadrant of the compass as the ship is swung round. It is not required that a ship should change her geographical position to show the existence of either of these effects of the earth's inductive action, though it is only by such change that the full effect of the former can be properly estimated. By experiments with the vibration needle, a change in the value of the ship's magnetic force will be observed as she is turned with her head in opposite directions. Two values are thus obtained, which give the sum and difference of the ship's permanent magnetism, and that due to induction, the changing vertical, and the changing horizontal, for the place of the experiment. The Astronomer Royal has shown that the chief feature of the ship's vertical induced magnetism, in this hemisphere, is to constantly diminish the earth's directive power on the compass needle. There is reason to believe that it is also, or rather that it gives rise to, a fluctuating quantity which is liable to influence the deviation tables of ships that change their latitude only to a small extent or not at all, by a portion of it being retained for a time. In amount it appears to vary with the position of the ship, the time during which she remains in a given position, and the circumstances to which she may be subjected while maintaining it.

The following facts, with some experiments to be afterwards described, are offered by the Committee in support of this position:—(1.) Deviations observed with the Admiralty compass on board the Royal Charter, after she had been lying for some weeks head to N.N.E, differed by several degrees from those observed after she had been for ten days with her head to W.N.W. (2.) Captain Toker, of the Drogheda paddle-wheel steamer, plying between Liverpool and Ireland, states that he has commanded her for seven years, during which time she has had her compasses adjusted twice or thrice. The compass adjuster stated on the last occasion, that he had not known any ship which, after the lapse of three years, required so little alteration. The Captain informs the Committee that after each time she has been in the graving dock, head N.N.E., for a few days, to be scraped and painted, he has observed her to deviate considerably to the north of her course, both in going to and returning from Ireland. He could not offer any reason for this. On the first occasion of his noticing it he sailed in company with another steamer; instead of keeping parallel with her, as had been usual, he remarked that her Captain had changed his course; eventually he discovered that it was himself that had done so, though he appeared by compass to be steering as before. After making a few voyages this extra deviation disappeared, and he was able to steer his accustomed courses. These deviations indicate increased attraction aft, and would probably arise from the ship's northerly position when in graving dock. (3.) The captains and overlookers of several steamers trading to the Mediterranean state that while in this sea they make certain courses very correctly; in attempting the same after leaving Cape Finisterre, with ship's head northerly and easterly for two or three days, they get to the north of their course. Thus, in the run from Point Lynas to the N.W. light-ship, or the Bell buoy, course about E.S.E., they sometimes get so much as six, eight, and nine miles to the north. The cause already spoken of appears an adequate one. (4.) Similar experience is reported by the captains of iron steamers on the North American lines. On the homeward voyage, towards Newfoundland, they get to the N. (or the left of their course), after making what is considered to be ample allowance for deviation and the rapid change which occurs here in their variation. (5.) The captain of the Laconia steam-ship, trading to the Mediterranean, stated that in two or three successive voyages, in departing from Cape Finisterre for the Irish Channel, he had kept the ship in the same direction throughout by the mast compass, and narrowly watched the steering compass; he had found its deviation gradually increase as he came northwards till, on reaching the Smalls, it amounted to three-quarters of a point. All these cases show a deviation to the north of the usual courses after the ship's head has been northerly for a short time, and they require some explanation of a general and comprehensive kind.

In this place may be introduced some particulars of the Committee's vibration experiments, as bearing especially upon this topic. They show fluctuations both in the amount and direction of a ship's induced magnetism of considerably greater extent than is generally supposed to exist. These fluctuations do not appear, however, to affect *practically* an authoritative statement, which has already been supported by the Committee, and which, as it forms the key to the correction and calculation of compass deviations, cannot be too earnestly repeated—namely, that a ship's magnetism for any given place may be very closely represented by a permanent polar magnetic force in combination with a quadrantal force, or one changing its deviation in each quadrant as a ship is swung round.

In reference to the disturbance of the compass due to horizontal induction or quadrantal deviation, the Committee remark that its peculiar character is too frequently overlooked. This is the more to be regretted as in all the iron merchant ships and steamers which have been examined in Liverpool it forms an important feature. Unless its character be under-

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stood and its value estimated, an approximate curve of deviations cannot be projected, from four observations, with any chance of success. Two cases have been named in which it exceeded a point; on board the Royal Charter it amounted to six and seven degrees. In such instances it might give rise to an uncertainty in the deviation of twice this amount.

While the deviations arising from permanent magnetism and vertical induction vary as the sine of the angle of direction of ship's force, at the station of the compass, with the magnetic meridian as indicated by the disturbed needle, the quadrantal deviation has been shown to vary as the sine of twice the azimuth of ship's head by disturbed compass very nearly. In practice these two deviations are combined in every conceivable manner. With the exception of one or two cases of elevated compasses, the whole of the deviation tables which have been obtained in Liverpool by the Committee have exhibited *plus* quadrantal attraction. Perhaps a *minus* deviation of this kind would be found to exist in a compass placed within a skylight, in which the iron deck beams are cut off on each side of it, or in an iron ship with wooden beams.

Following the remarks of the Committee we next come to the following practical topics:—1. Errors induced by heeling in iron ships. 2. Elevated or mast and standard compasses. 3. Modes of swinging ship. 4. Modes of adjusting compasses. 5. Projection of deviation tables by curves. 6. Miscellaneous operations of the Committee.

The errors arising from the heeling of iron ships are among the most perplexing which demand a captain's attention. As a number of causes may conspire to produce, modify, or cancel their effect, it is not surprising that the evidence before the Committee on this branch of the investigation was not very complete. Among such causes may be named the following:—*a.* The rising or lowering of the attracting mass, causing its magnetism to act with more or less leverage as it approaches to or recedes from the plane of the compass card. *b.* Vertical iron or magnets below and near the compass. *c.* Induced vertical polarity in iron deck beams, increasing as they incline from their usual horizontal position. *d.* Proximity of badly proportioned and badly placed chain-boxes. *e.* Action of horizontal compensating magnets when they are placed below and too near the compass card. The last, though partially corrective of some errors from heeling, in certain positions of the ship, appear to aggravate them in others.

The three first-named causes are described as tending to attract the north end of the needle to the weather side of the ship in north magnetic latitude, and to leeward in the south magnetic hemisphere, and as increasing or decreasing the usual deviations, according to their name and the direction of the ship's head. These three may act in the same direction and in the same ship. It is difficult to estimate their separate effects, but the last is supposed to be most prejudicial. The great expense attendant on heeling and swinging ship in port, and the delay caused by such an experiment where every hour is valuable, have prevented the Committee from directly testing this. Deductions can only be made, therefore, from the evidence afforded by various captains and an inspection of the arrangement of the iron near the compasses of their respective ships. Evidence from a number of captains shows:—1. That in a large proportion of iron ships the compasses are affected by heeling. 2. That errors from heeling are generally most complained of when ships are on or near four-point courses. 3. That when iron ships have heeled over for a considerable time upon northerly courses, they have been found to windward of their dead-reckoning. To these may be added, the existence of an impression among compass adjusters and others who have paid attention to the subject (among the latter may be named the managing owner of the Cunard Company, Mr. Charles M'Iver, a gentleman of great experience in iron ships), that iron deck beams are a chief cause of compass disturbances.

The following may also be quoted from a number of other cases:—Captain Bonfellow of the steam-ship Laconia states, that the same course which, with an even beam, would make the Smalls from the coast of Spain, with wind at N.W., would make the Tusker to windward, and on the opposite side of the Irish Channel. The captain of the Sarah Sands states, that his compensated steering compass has acted remarkably well, except when his vessel has heeled to some extent. This compass is placed over, and comparatively near, large masses of vertical iron. Captain Leitch, of the City of Baltimore steam-ship, has favoured the Committee with observations made during several voyages. In every instance the north end of the needle has been attracted to the high, or weather side of the ship. This is the most extreme case which has been recorded. From slight list to starboard to slight list to port, the standard compass, placed about five feet above the deck-house, has been observed to change eight degrees. The apparent cause is the iron beams of the deck-house. There seems reason to suppose that when the deck beams are divided to make space for a skylight, a position for a compass may be found in which the errors from heeling might naturally compensate each other. The errors from vertical induction of deck beams would certainly vary with change in geographical position, or with the earth's vertical intensity. Thus, in the City of Baltimore, Captain Leitch mentions variations in the deviation of three-quarters of a point while his ship was in the Mediterranean; but in the North Atlantic, as he approached America, he has noticed an extreme instance of more than a point and a half. The Committee are anxious to collect all the information possible on this intricate and important section of the compass inquiry, as it is felt how very imperfect must be any deductions which may be made from the evidence which has to this time been placed before them.

Great variety of opinion prevails as to the utility of mast compasses. Though in some ships they have been discontinued after a trial, their use is becoming very general, although they certainly are not always free from a considerable amount of error. In moderate weather and large ships, mast compasses are stated to act well; but in small ships, where the motion is greater, the oscillation prevents their being of service, except in fine weather. In nearly every case they show an attraction to ship's head in north magnetic latitudes (giving east deviation with ship's head east, and west deviation with ship's head west, *taking ships to the south of their course*), and very little quadrantal deviation. The usual *plus* quadrantal deviation is found to decrease as the compass is carried aloft, and is believed, in some cases, to change to *minus* quadrantal after a certain elevation is attained. The effect of the transverse iron, and iron placed before and aft the compass, appears to be cancelled, and in some cases exceeded, by the action of the ship, as a long bar placed below the compass. The Astronomer Royal has, however, exceedingly little faith in the use of compasses at the mast head. Relying on the result of Dr. Scoresby's observations in the Royal Charter (which were extensively published soon after his return), he (Professor Airy) recommended to the Admiralty that such a mounting should be tried in the Trident, and in a recent number of the *Athenæum* he communicates the facts of the case. Among the places which are left at liberty by the rigging of the ship, the best (in a magnetic sense) was, he says, selected; and great care was taken to mount the compass in an unexceptionable manner. It was, however, totally useless. Its deviations were so large that it could give little assistance in interpreting the indications of the compass below; and when compared with a corrected compass, and above all with a corrected adjustable compass, it was of no use whatever. The Astronomer Royal further remarks that the deviations of the mast-compass of the Great Eastern are large; that that of the Royal Charter became useless from sluggishness, produced, he conceives, by the injury done to the pivots and bearings by the tremor of the mast; and that he does not think the method will ever be extensively used.

We now come to the question of the best modes of swinging ships. Undoubtedly, the easiest and best mode of ascertaining the deviations of a compass is by reference to the bearings by it of a distant object, whose true magnetic direction is known; but, in a river or a confined dock, such distant object is seldom attainable. Next to this, the Committee approve of the system of fixed magnetic bearings of a conspicuous object, which has been adopted at Liverpool. The principle is the same as that of reciprocal bearings, with the two advantages of freedom from error in the shore compass, and saving the time usually lost in repeating and deciphering the shore signals. There is another mode sometimes adopted in Liverpool and at other places—that of carrying the shore compass round the dock, so as always to be in a line with the ship's masts, and by preconcerted signals checking the ship as she approaches the true points of the compass. This plan does not admit of accuracy, even when pains are taken to insure it. To an adjuster who understands his business it must be tedious, while in the confined situations, in which only it can be employed, the shore compass is liable to varying disturbances, which give rise to most inconsistent tables of deviations. In some cases it has occasioned serious errors.

At this point we must pause for the present.

THE CASE OF HENRY CORT,

AND

HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

X.

DURING the period embraced in the account of Cort's invention, and its introduction already given, everything had gone on with greater success than had attended any inventor. The merits of the invention were not only placed beyond a question, but the merit of the inventor was universally acknowledged. The mill at Fontley was in full operation, and visited by the large manufacturers anxious to be informed as to the best means of practising the new manufacture. Licences were taken at royalties estimated to yield £250,000 to the owners of the patents.

At this crisis, 1788, Adam Jellicoe, the partner of Cort, committed suicide, under, it would appear, the pressure of dread of exposure of being a defaulter to the amount of £27,500 of public money entrusted to him, and for which

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he was responsible, for wages of seamen and officers of the navy.

The following letter, found in the iron chest of Adam Jellicoe by G. Black, an accountant employed by Mr. Trotter, the Paymaster, to schedule Jellicoe's effects preparatory to the extent, in 1789, dated 11th November, 1782, throws some light on the causes of the act:—

"Ever since I have had public money in my hands, it has been a constant rule with me to have the value of it in Navy bills in the iron chest, that in case of my death the balance might be immediately paid in; and I have always had much more than my balance by me, till my engagement about two years ago with Mr. Cort, which by degrees has so reduced me, and employed so much more of my money than I expected, that I have been obliged to turn most of my Navy bills into cash, and, at the same time, to my great concern, am very deficient in my balance. This gives me great uneasiness, nor shall I live or die in peace till the whole is restored.

"But should my death be *sudden*, and before I can make up the public balance, I hope I shall not be reflected on, as I have always meaned honestly and justly; and I must earnestly entreat the Treasurer, Paymaster, or whoever is most concerned, not to be severe in requiring the balance to be immediately restored, lest my character should be traduced, and my son Samuel (*who I hope is in a way to make a comfortable provision for his brothers and sisters*) and my family be ruined.

"I have considerably more than £20,000 engaged in the business with Mr. Cort and my son, and have paid almost all my engagements and acceptances. I expect the returns in bills for ironmongery wares will now come in very fast; besides which, General Tonyn owes Mr. Cort nearly £3,000, which Mr. Wilkinson, in Abchurch-lane, assures me is as safe as if I had it. Mr. Morgan, the Purser (whose name is in the contract for iron wares), owes Mr. Cort near £3,500. Both these debts are assigned to Messrs. A. and S. Weston, 31 Fenchurch-street, for my use. Messrs. Weston have also in their hands monies received from Captain Wm. Hay and Captain O'Hara, in the Royal Navy, due to Mr. Cort and assigned to me.

"Mr. Sykes' agent, in Crutched Friars, has a Navy bill of mine, value £2,800, with interest due on it, on which I borrowed £2,000 of him. Mr. Weston above-mentioned will, in case of my sudden death, assist in raising money for me, as I doubt not Messrs. Bennett and Cure, Fenchurch-street, to save me from any imputation, and my family from being hurt; and they may be sure of being repaid by remittances from Mr. Cort and my son, so that I hope my balance will shortly be made up; and as I have ever meaned to deal justly and honestly with the public and every private person, I again entreat that some favour may be shown to the family of one who has served faithfully for above forty years, and that it will not be insisted upon that the balance be immediately paid up. (Signed) "A. JELLICOE.

"P.S.—I have also a mortgage of £4,000 on the estate of Mrs. Catherine Dent, and above £800 interest due on it."

The following affidavit in the Exchequer of Mr. Trotter, shows the liability thrown on Cort by the proceedings of his partner:—

"Alexander Trotter, of the Navy Pay Office, Esquire, and Paymaster of His Majesty's Navy, maketh oath and saith, that Henry Cort, of Gosport, in the county of Southampton, iron manufacturer, is justly and truly indebted unto His Majesty in the sum of £27,500 and upwards, for so much of His Majesty's money paid by the deponent as Paymaster of His Majesty's Navy unto Adam Jellicoe, late of Highbury-place, in the county of Middlesex, Esq., the chief clerk in the pay branch of the office of the Treasurer of His Majesty's Navy, for the purposes of his paying and applying the same in discharge of the wages of the officers and seamen of His Majesty's Navy, but which said sum the said Adam Jellicoe did not pay and apply for the purpose for which this deponent paid him the same, but which said sum he the said Adam Jellicoe at different times lent and advanced unto the said Henry Cort, from whom the same now remains justly due and owing; and this deponent saith he verily believes that the said Henry Cort is much decayed in his credit and in very embarrassed circumstances, and therefore this deponent verily believes that the aforesaid debt so due and owing unto His Majesty is in great danger of being lost if some more speedy means be not taken for the recovery than by the ordinary process of this Court.

(Signed) "ALEX. TROTTER."

The action taken on this affidavit was most remarkable. The then Treasurer (Mr. Dundas) adopted a liability for which he was in no way honourably or otherwise liable, as more than £20,000 of the sworn debt had been abstracted eight years previously, during the trust of Mr. Wellbore Ellis. Between 1781, when Mr. Ellis left office, and 1789, there had been four surrenders of trust in the office of Treasurer; as it was incredible, not to say impossible, that all these four persons could successively have overlooked Jellicoe's current default, so well known in the office, there must have been some strong consideration moving Mr. Dundas and Mr. Trotter to have induced them to incur the risk of perjury in order to assume unnecessarily a debt to the Crown of £27,500 and upwards. In the previous year, 1788, Mr. Dundas had called upon A. Jellicoe to restore his defalcation, and make good his balance, to which intimation Jellicoe replied, July 10th, 1788: "But (in the meantime) in case you should think a security necessary for the responsibility of the situation which I have the honour to hold, I beg leave to offer the enclosed (bonds and assignments of Mr. Cort's patents) amounting to a larger sum than I can at any time hope to have in my hands unemployed.—(Signed) A. Jellicoe." That Mr. Dundas thought very highly of the value of these securities at this time is shown by his memorial to the Treasury, May 1800, in which, referring to Adam Jellicoe's connection with "Mr. Cort, the patentee of an invention for making wrought from unwrought iron," he proceeds: "The sanguine hopes that were entertained of Mr. Cort's inventions becoming productive, and the inefficiency of harsher measures being considered, it was determined Mr. Jellicoe should not be immediately suspended, but that he should be pressed to use every exertion to pay up his balance." He then gives an account, *wholly false*, of the extent subsequently issued, immediately after A. Jellicoe's death, for he states that "all his effects were turned into money and paid in diminution of the debt," whereas it was discovered by the Commissioners of Naval Inquiry that Mr. Cort's freeholds in Hampshire had not been sold, but that Samuel Jellicoe, the son of the defaulter, had been put into possession of them, under the extent, and had continued peaceably to enjoy them without any process of the Crown up to the date of that report in 1803, a period of fourteen years; and the Commissioners likewise ascertained that out of the effects of Adam Jellicoe, scheduled by George Black, under the extent, at £89,657, a sum of only £13,895 had been placed by Mr. Trotter to the credit of the alleged default. "Everything available having thus been turned into money and paid in diminution of the debt," the mendacious memorial continues: "the patents granted to Mr. Cort were also secured, and for a long time hopes were entertained that Parliament would, by rewarding so beneficial an invention, have provided a further fund for lessening the debt," (*i.e.* the balance of the £27,500 and upwards sworn to by Mr. Trotter); "but that, notwithstanding the great merit of the invention—and the use of it to the country remains uncontested—no compensation has ever been made." If it be fair to interpret men's words by their actions, there can be little difficulty in reading what was in the minds of Mr. Dundas and Mr. Trotter, when they ruined Mr. Cort. At the date when he was turned out of his own works and other freeholds in Hampshire, and his partner, Jellicoe the younger, snugly installed in them, the Treasurer of the Navy had no greater difficulty before him in the way of obtaining payment either of the sworn debt of £27,500, or of the balance of it, than to carry the contracts "he had secured" to Mr. Richard Crawshay and others, and demand of them a payment of 10s. per ton of puddled and rolled iron, secured under their hand and seal, to the holders of those contracts. The Treasurer had the legal power to exact dues amounting between 1789 and 1798 to nearly £200,000. What he did receive could not be ascertained from the ashes of burnt documents, and he refused any personal information to the Commissioners in 1803, and to a Committee of the Commons in 1805; but, according to the memorial quoted, he had received nothing, for the balance of A. Jellicoe's default remaining unpaid in May, 1800, is stated in that document to be £24,846, which, subtracted from the sworn debt, leaves £2,654 and upwards as the total realised in eleven years to the public by the illegal seizure of the inventor's effects, and the peculiar surrender to his private partner of the freeholds seized under a Crown writ for the discharge of a public debt. When we consider how very simple was the process of demanding of the contracting iron-masters the patent dues, which for the year 1789, at the date of the extent, amounted to £15,000, £15,000 more in 1790, and £25,000 more in 1791, and which demand might have been enforced by the same legal process used to ruin the inventor, it is not difficult to surmise the motive for abstaining. Mr. Whitbread with great, but surely not undue severity, charged Lord Melville, upon this memorial (the prayer of which was acceded to without examination) with obtaining a receipt or discharge from the Treasury for this £24,846, "under false pretences."

Such is a brief outline of the facts connected with the lamentable suicide of Cort's partner, and the conduct of the authorities, which was made the subject of further investigation in 1805 on the question of the impeachment of Lord Melville.

Her Majesty's ship Wrangler returned to Woolwich yesterday from an experimental cruise to try the 40 lb. and 80 lb. Armstrong guns at sea. A most complete course of experiments was carried out under the inspection of Capt. Sir William Wiseman, Vice-President of the Royal Ordnance Select Committee of Woolwich Arsenal, and Lieut. Thomas L. Ward, of the gunnery-ship Excellent. Sixty rounds of ammunition with the elongated shot were fired with perfect success, and every equipment pertaining to the gun was pronounced faultless.—*Times* of Saturday last.

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Literature.

Ure's Dictionary of Arts, Manufactures, and Mines. New Edition. Edited by R. HUNT, F.R.S., &c. Part II., December, 1859. London: Longman and Co.

WE observe now what we did not notice when the first part of the work was recently before us, viz., that this new edition is to be published in *monthly* parts. In a twelvemonth's time, therefore, the re-issue will be completed. This is a most satisfactory arrangement.

This part shows that the great improvements noticed in the first were not put forward as mere beguilements to purchasers. The labour and expense bestowed upon the new edition are as manifest here as they were in it, the 384th page of the present part carrying us only to the article Borax, which appeared on the 234th page of the edition of '53. We have new articles on Artillery (9½ pages), the Atomic Theory (3 p.), Borwood (1 p.), Bells (1 p.), Benzole (1½ p.), Boghead coal (2 p.), the commencement of an elaborate one on Boring, and some scores of shorter ones. At the same time many of the old articles are extended—that on Barley from 10 lines to 1¼ pages, on Bismuth from 2 to 8½ pages, on Bleaching from 17½ to 33½ pages, on the Blowpipe from 6 lines to 3 pages, on Boracic Acid from ¼ to 2 pages, on Borax from 2 to 3, and so forth. The article on Bleaching deserves particular notice, as it contains a large mass of new and valuable matter, and is illustrated by a truly beautiful display of engravings on wood. We recommend readers—all who can afford five shillings a month for the purpose—to put themselves in possession of the parts of this edition of Dr. Ure's unexampled work without delay.

Stories of Inventors and Discoverers in Science and the Useful Arts. A book for Old and Young. By JOHN TIMBS, F.S.A., Author of "Curiosities of London," "Things not Generally Known," &c. With Illustrations. London: Kent and Co. (late Bogue), Fleet-street. 1859.

MR. TIMBS has here contrived to put forward 350 pages on inventors and discoverers without once acknowledging (so far as we can observe) that he is at all indebted to the MECHANICS' MAGAZINE for any of his facts or statements. This will seem a curious circumstance to those who know how prominent a place this Magazine has held for *thirty six* years past in connection with inventions and discoveries in "science and the useful arts;" and we may, without vanity, say that he might have avoided some errors had he given greater heed to what has been published here. But having intimated this we hasten to express our sense of the great value of the volume before us. It is, indeed, "a book for old and young," and such a book as no other compiler known to us could be expected to produce. Mr. Timbs does not bestow his labour grudgingly upon these volumes of his which are appearing every few months. They are well thought over, and worked at energetically. This volume is one which no man in England, be he ever so cultivated, need be ashamed to peruse, or could peruse without deriving much instruction from it.

The Gardeners' Year Book, Almanack, and Directory. 1860. By ROBERT HOGG. London: *Cottage Gardener* Office, 162 Fleet-street, E.C.

MR. HOGG—who is a Vice-President of the British Pomological Society, author of "British Pomology," "The Vegetable Kingdom and its Products," and co-editor of the *Cottage Gardener*—has here started an exceedingly useful and cheap annual. The number for 1860 contains 150 pages of well-selected matter, and is so admirably edited that the success of the author's undertaking will be assured by it.

Cassell's Illustrated Almanack for 1860. London: Cassell, Petter, and Galpin, La Belle Sauvage Yard.

THIS almanack abounds in exceedingly well-selected matter, is lavishly illustrated, and is unexampled for cheapness.

On the Comparative value of Certain Salts for rendering Fabrics Non-inflammable. By FRED. VERSMANN, F.C.S., and ALPHONS OPPENHEIM, Ph. D., A.C.S. London: Trübner and Co., 60 Paternoster-row. 1859.

THIS pamphlet forms the substance of a paper read before the British Association at the Aberdeen meeting in September last. An article, which we recently published on uninflammable fabrics (which was copied into most English newspapers, and translated into several foreign journals), and a letter from the authors which appeared in our "Weekly Gossip" a week or two since, render further description of the pamphlet unnecessary.

Our Military Engineers; being an Inquiry into the Present State of Efficiency of the Corps of Royal Engineers. London: Judd and Glass, 38A New Bridge-street, and Gray's-Inn-road.

THE conclusion at which the author of this anonymous pamphlet arrives, after giving the matter the fullest attention, is that the separation of the Civil and Military duties of the officers of the corps of Royal Engineers is unavoidable, if we wish to preserve the corps. They cannot exist as they are at present. "They may contrive to bungle over their civil duties with the assistance of the civilians attached to the department, but having no one to perform the military duty for them, their utter worthlessness as a professional corps will be fully exposed. How they contrived to hush up their deficiencies in the Crimea cannot be imagined, unless it is attributed to the unity which prevails among them; for there is no body of men who adhere so well to each other in concealing their deficiencies from the authorities and the public as the officers of the corps of Royal Engineers."

Having in view the difficulty which might be supposed to arise in the separation of the civil and military duties of the corps of Royal Engineers, the author believes that all difficulties may be got over by confining the corps to the practice of military duties—which would include the construction of works of fortification, the practice of military bridges, pontooning, siege operations, light infantry manœuvres, &c., being under the control of the Commander-in-Chief. The exclusively civil duties which they are now supposed to perform, and consisting of the designing, executing, and repairing barrack buildings, storehouses, the management of War Office lands, &c., should be handed over to a civil corps analogous to the Military Store Department, and subject to the Secretary-at-War. This corps would be available in time of war as a substitute for the late Army Works Corps, and could be made to perform the professional duties required in connection with Quarter-Master-General's Department, thereby permitting the employment of the corps of Royal Engineers solely in the military operations of a siege. The Civil Corps is to be composed of men who, previous to their appointment, have received a practical training in architecture, civil engineering, building, &c.

LIST OF NEW BOOKS.

Aberdeen's Principles of Beauty in Grecian Architectur .s.
Donaldson's Architechera Numismatica, illust., 63s.
Encyclopædia Brittanica, 8th edit., by Trail, vol. 19, 24s.
Hogg's Gardener's Year-Book, Almanack, and Directory, 1860, 1s.
Keith's Coming Events cast their Shadows Before, 2 vols., 21s.
Smile's Self-Help, with Illustrations of Character and Conduct, 6s.
Tennant's Ceylon, Physical, Historical, &c., 2nd edit., 2 vols., 50s.

The steel-plated frigate Gloire was launched at Toulon at half-past 11 on the morning of the 24th inst., in presence of an immense concourse of spectators. A vast multitude, anxious to see the launch, occupied every point from which the dockyard of the Mourmillion is visible. The harbour presented a most animated appearance. Thousands of boats formed a line to hail the Gloire on her passage to the sea, which she accomplished with perfect success.—*Times.*

Proceedings of Societies.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, Nov. 15th, 1859. Mr. J. C. Dyer, Vice-President, in the Chair. Mr. John Atkinson made a communication respecting a curiously-shaped fossil, found about a month ago in the Upper New Red Sandstone in a quarry near Runcorn. This fossil had been described in the *Athenæum* of the 29th of October last by Mr. Henry Wilson, Surgeon, Runcorn, who pointed out its striking resemblance to the mullion and tracery of part of an ancient gothic window, not merely in size and general outline, but in the moulding upon it, as if of tooling by the hand of some primitive mason. On the 5th instant the *Athenæum* contained two letters on the same subject. Neither of the writers had seen the fossil. Opinions being divided, Mr. Atkinson visited the Runcorn Hill Quarry, examined the fossil itself, and found it to be a mass of fine-grained sandstone veins. These had been deposited in thin horizontal laminæ and moulded in a system of cracks formed by desiccation and subsequent modification—probably by the action of water—in the bed of marl (here eight inches thick) so celebrated as being that on which the last of the Labyrinthodon order of animals have left their footprints in such vast abundance at Stourton, Runcorn, Lymm, and various other localities. Professor Roscoe communicated a paper by W. S. Jevons, Esq., late Assayer in the Sydney Branch of the Royal Mint, entitled, "Observations on the Gold Districts of Australia." At the close of the paper the author considers the important question of the probable future yield of gold to be expected from Australia. He believes that no more very large or rich fields of alluvial gold will be discovered in Victoria, but that the present "gold-drift" has by no means been worked out; so that when capital and more complete mechanical appliances are brought to bear upon the ground which the first gold-digger has relinquished as worthless, a constant and remunerative supply of gold can be relied on. It is otherwise, the author believes, with the true gold mines, those in which the auriferous quartz reef is worked. Here the supply is, as far as we know, unlimited—the assertion that quartz reefs became poorer in gold as they decend being as yet quite unproved, so that when the due combination of science and capital has been brought to bear upon the subject, there seems to be no reason why the auriferous quartz reef should not be followed as far as any other metal-bearing vein, as in the Cornish tin mines or in the silver mines of Mexico and Peru. Hence the author concludes that the supply of gold from Australia will probably continue to be large and regular.

Mathematical and Physical Section, Nov. 10th, 1859. Mr. T. Heelis read a paper "On Storms, with some attempt to ascertain their tracks in the neighbourhood of the British Islands, and their analogy to other Cosmical Phenomena."

MEETINGS FOR THE ENSUING WEEK.

MON.—*London Inst.*, "On the radiation and absorption of heat," by Professor J. Tyndall, F.R.S., at 7 p.m.

TUES.—*Nat. Civil Engineers*, Continued discussion on Mr. Grantham's paper "On Arterial Drainage and Outfalls." At half-past nine the visitors will adjourn to the library, when candidates will be balloted for.

WED.—*Royal Inst.*, "On the Physical History, Structure, and Materials of the Earth," by E. W. Brayley, Esq., F.R.S., at 7 p.m.
Society of Arts, "On the forces used in Agriculture," by Mr. J. C. Morton, at 8 p.m.

THU.—*Royal Society*, I. "On the Analytical Theory of the Attraction of Solids bounded by the surfaces of a class including the Ellipsoid," by Prof. Donkin; II. Supplement to a paper on the Thermodynamic Theory or Steam Engines with dry saturated steam, and its application to practise," by Prof. Rankine; III., "On the effects produced in Human Blood by Sherry Wine," by Dr. Addison; IV. "Supplement to a paper on the influence of White Light of the different coloured rays, and of darkness on the development, growth, and nutrition of animals," by Mr. H. Dobell, at 8.30 p.m.

FRID.—*London Inst.*, "On certain principles of vegetable and animal chemistry," by F. A. Malone, Esq., F.C.S., at 7 p.m.

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EXPERIMENTS ON THE STRENGTH OF CAST IRON GIRDERS.

By J. G. LYNDE,* M.I.C.E.,* F.G.S.

THE following paper was read at the Manchester Literary and Philosophical Society, Nov. 1, 1859.

The beams experimented on were eighty-nine in number, and were cast by Mr. Mabon, at the Ardwick Iron Works, Manchester, from iron of the following descriptions:—

One charge of the cupola consisted of
12 cwt. Goldendale, Staffordshire.
12 " Lane End.
12 " Ormesby, Yorkshire.
12 " Blair, Scotch.
12 " Calder, "
All No. 3 hot blast iron.
12 " scrap.

The beams were cast on their sides, and were a very good sample of workmanship.

The section of each beam was of the form recommended by Professor Hodgkinson, and upon which his formulæ were based; the total depth of the beam in the centre was 24½ inches, and at the ends 20 inches; the bottom flange was 15 inches wide, and 2½ inches thick; the vertical part of the beam was 1½ inch thick; and the top flange was 4½ inches wide, and 1½ inch thick; the total length of the beam was 34 feet 6 inches, and the distance between the supports was 30 feet 9 inches; the weight of the beam was 3 tons 8 cwt. 1 qr.

One of the beams was tested up to the breaking weight with the following results:—

With a load in the centre of—

Tons.	Cwt.		Inch.
31	8	the deflection was	·87.
42	16	"	2·00.
46	12	"	2·25.
50	8	"	2·56.
54	4	"	2·70.
58	0	the beam broke,	

the ends springing back from each other 2 feet 3 inches, the fracture indicating a good sound casting.

There was no permanent set observable in any of the experiments, until the breaking weight was applied, the beam being allowed to recover itself on the removal of the load in each case.

Each of the remaining beams was tested with a load of 20 tons in the centre, the deflection varying from ⅛ths to ¼ths of an inch.

The calculations for the strength were based on the following formulæ, given by Professor Hodgkinson in his "Experimental Researches on the Strength and Properties of Cast Iron:"—

First formula, art. 146:

Let W = the breaking weight in tons placed on the centre of the beam,
a = the area of the bottom flange in inches,
d = the total depth of the beam in inches,
l = the length between the supports in feet,

then $W = \frac{2{\cdot}166\ a\ d}{l}$

In this case $a = 36$,
$d = 24{\cdot}25$,
$l = 30{\cdot}75$,

which gives 60·09 tons as the breaking weight of the beam.

The second formula, art. 147, takes into account the thickness of the vertical part of the beam, and is as follows:—

Let W = the breaking weight in tons placed on the centre of the beam,
l = the length between the supports in feet,
b = the breadth of the bottom flange in inches,
b' = the thickness of the vertical part in inches,
d = the whole depth in inches,
d' = the depth from the top of the beam to the upper side of the bottom flange in inches,

then $W = \frac{2}{3\ d\ l}\left(bd^3 - (b-b')d'^3\right)$.

In this case $l = 30\ 75$,
$b = 15$,
$b' = 1{\cdot}5$,
$d = 24{\cdot}25$,
$d' = 22{\cdot}03$,

which gives 62·19 tons as the breaking weight of the beam.

The actual breaking weight being 58 tons, it would appear that the constant co-efficient assumed is in each instance too high for the quality of iron of which these beams were cast. This result appears to have been anticipated by Professor Hodgkinson in the case of large beams; and in one of his experiments, art. 147, on a beam cast for Messrs. Marshall and Co., of Leeds, he gives ·625 as the co-efficient, which agrees with the result of this experiment.

Applying this co-efficient to Professor Hodgkinson's formulæ, they will be as follows:—

First formula, $W = \frac{2{\cdot}05\ a\ d}{l}$

Second formula, $W = \frac{{\cdot}625}{d\ l}\left(bd^3 - (b-b')d'^3\right)$

The first of these would give 58·2 tons, and the second 58·31 tons, as the breaking weight; either of which calculations would be sufficiently correct for any practical purpose.

ON THE ANGLE OF DOCK GATES AND THE ROOF OF THE BEE'S CELL.

By CHARLES M. WILLICH, Actuary University Life Assurance Society.*

THE proper angle at which dock gates should be placed, so that the timber employed should yield the most favourable result, has often been discussed by mathematicians, and determined as a problem of maxima and minima. The angle has been found to be 109° 28′ 16″

A patient investigation of the properties of the cube has enabled me to succeed in dividing it into several geometrical solids, with which many definite and regular geometrical bodies may be constructed. The dodecahedron with 12 rhomboidal faces is composed of 2 cubes, 6 octohedrons, or 4 oblique rhomboidal cubes. The obtuse angle on its face measures 109° 28′ 16″, being the same as that adopted by mathematicians for the angle of dock gates; and by Maclauren in the beginning of the last century as the best for the angle of the roof of the bee's cell. It will be readily seen by the models submitted with this paper, that by elongating the dodecahedron, it becomes the precise form of the bee's cell, with angles measuring 109° 28′ 16″.

I have succeeded in dividing or parting the cube in two different ways. 1st. By lines from the centre to the 8 solid angles of the cube, which will give 6 four-sided pyramids. 2nd. By lines from one of the upper angles of the cube, drawn diagonally to the 3 opposite angles, dividing the cube into 3 equal and uniform solids. Each of these solids being halved forms a left and a right-handed solid. These 6 solids, though equal in solidity, differ so far in shape, as 3 are left-handed and 3 right-handed, in the same way as the hands of the human body.

Each of the six bodies obtained by the second mode of partition may be divided into two of equal solidity and of similar shape. Two of these bodies, each being one-twelfth of the cube, may be so united as to produce the pyramid obtained by the first mode of partition. Six of these bodies, each being one-twelfth part of a cube, may be so arranged as to form the oblique rhomboidal cube.

It may also be observed that the pyramid, or one-sixth of the cube obtained by the first mode of partition, may be divided into four bodies, each of which is one-third of a cube containing one-eighth of the mass of the cube from which it was derived. So that, in fact, we may go on dividing and reproducing bodies of a similar shape, and still retaining the diagonal lines of the cube. How far this subdivision may be carried in nature, or how much farther than our powers of vision go, I will not at present venture an opinion. We can imagine the commencing atoms may be infinitely small, when we remember the wonders revealed by the microscope.

List of Models accompanying Mr. Willich's paper.

No. 1. Model of bee's cell, composed of seven rhomboidal cubes. By taking away 3 of these cubes, the dodecahedron with rhomboidal faces is left, as composed with 4 rhomboidal cubes. The solid content of the dodecahedron is equal to two cubes, whose side is equal to the shortest of the diagonal lines of the rhomboidal face.

No. 2. The rhomboidal dodecahedron as composed with six octohedrons.

N.B. The cubic octohedron with which the dodecahedron is composed, is not the regular platonic body with eight faces, which are equilateral triangles, and which may be obtained by a partition of the tetrahedron; but this cubic octohedron has each face with two angles of 54° 44′ 08″, and one of 70° 31′ 44″, being, in fact, one-half the rhombus on the face of the dodecahedron. This octohedron is composed of two of the six pyramids into which a cube may be divided, as seen by the model.

No. 3. Cube marked with lines to show its partition into six bodies.

No. 4. Cube built up with the six bodies.

No. 5. Two of No. 4. united to form one-third of a cube.

No. 6. One of these bodies of which No. 4 cube is composed, being one-sixth of a cube divided into two, A and B, each being one-half a pyramid or one-twelfth of a cube.

No. 7. A rhomboidal cube, composed of six half-pyramids. Seven of these rhomboidal cubes form the bee's cell (see No. 1), and four form the dodecahedron.

No. 8. Pyramid, being one-sixth of a cube or one-half of the cubic octohedron.

No. 9. Pyramid, divided into four bodies.

N.B. No. 8 and 9 together form the cubic octohedron.

No. 10. One-quarter of a pyramid divided and re-united so as to form one-third of a cube, which is one-eighth of the solidity of the cube from which the pyramid was derived.

N.B. This body is of the same form as No. 5; but only one-eighth of the solidity. No. 10 may also be produced at once by dividing the pyramid into four of these bodies, by quartering across instead of diagonally; so that the one-eighth part of the pyramid unites either way to form the quarter of the pyramid, cut diagonally or across.

No. 11. To show that by the union of the half-pyramids a prism may be formed.

THE INVENTION OF THE HOT-BLAST USED IN IRON-MAKING.*

THE following history of the invention of the hot-blast used in iron-making was recently presented to the Institution of Mechanical Engineers in a speech by Mr. Neilson, the inventor of the hot-blast system:—

Six or seven years before he brought out the plan, he had read a paper before the Glasgow Philosophical Society on the best mode of taking out the moisture from the atmospheric air in summer time, previous to its entrance into the furnace through the tuyeres; for it was found that the make of iron was much impaired in summer weather both in quality and quantity, and he had become satisfied that the cause lay in the greater proportion of moisture contained in the air at that season. His first idea was to pass the air through two long tunnels containing calcined lime, so as to dry it thoroughly on its way to the blast cylinder of the blowing engine; but this plan was not put to trial. About that time his advice was asked by a friend, Mr. James Ewing, of the Muirkirk Iron Works, in regard to a blast furnace situated at a distance of half-a-mile from the blowing engine, which did not obtain a sufficient supply of blast at that distance, and consequently did not make so much iron as two similar furnaces situated close by the same engine; and it then occurred to him that since air increases in volume according to its tempera-

* Read before the British Association at Aberdeen, September 20, 1859.

* The publication of this article has been unavoidably delayed for several weeks.

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ture, if it were passed through a red-hot vessel before entering the distant furnace, its volume would be increased, and it might be enabled to do more duty in the distant furnace. Being at that time engaged in the Glasgow gas works he made an experiment at once on the effect produced upon the illuminating power of gas by a supply of heated air brought up by a tube close to the gas burner; and found that by this means the combustion of the gas was rendered more perfect and intense, so that the illuminating power of the particles of carbon in the gas was greatly augmented. He then tried a similar experiment with a common smith's fire, by blowing the fire with heated air; the effect was that the fire was rendered most brilliant, with an intense degree of heat, while another fire blown with cold air showed only the brightness ordinarily seen with a high heat. Having obtained such marked results in these small experiments it then occurred to him that a similar increase in intensity of combustion and temperature produced would attend the application of the same plan on a large scale to the blast furnace; but his great difficulty in further developing the idea was that he was only a gas maker, and could not persuade ironmasters to allow him to make the necessary experiments with blast furnaces at work. At that time there was great need of improvement in the working of blast furnaces, for many furnaces were at a stand for want of blast, being unable to maintain the necessary heat for smelting the iron; and unless as much as £6 per ton could be obtained for the iron no profit was realised, on account of the heavy expenses attending the furnaces. A strong prejudice was felt against any meddling with the furnace, and a kind of superstitious dread of any change prevailed, from the great ignorance of furnace managers with respect to the real action going on in the furnace, and the causes of the fluctuations that occurred; when a furnace was making No. 1 iron no one would be allowed to touch it, for fear that if any change took place it might be many weeks before the furnace got round again from white iron. He at length succeeded, however, in inducing Mr. Charles MacIntosh of Glasgow and Mr. Colin Dunlop of the Clyde Iron Works to allow him an opportunity of trying the application of heated air for blowing a furnace; and though the temperature of the air was raised but little, not more than about 50° Fahrenheit, he was glad to be allowed to make a trial even with so small an amount of heat. This first imperfect trial of hot blast, however, with a rise of temperature of only 50°, showed a marked difference in the scoria from the furnace, causing it to be less black, or containing less iron; and he was therefore anxious to try the plan on a more extensive scale, in order to satisfy himself as to the change in the make of iron, and to establish the correctness of the principle. He was still retarded by the strong objections of ironmasters to any alterations in connexion with the furnaces, which prevented him from making the necessary experiments for ascertaining the best way of carrying out the plan: in one instance where he had so far succeeded as to be allowed to heat the blast main, he asked permission to introduce deflecting plates in the main, or to put a bend in the pipe, so as to bring the blast more closely against the heated sides of the pipe, and also increase the area of heating surface, in order to raise the temperature to a higher point; but this was refused, and it was said that if even a bend were put in the pipe the furnace would stop working. These prejudices proved a serious difficulty, and it was two or three years before he was allowed to put a bend in the blast main; but after many years of perseverance at the subject he was at length enabled to work out the plan into a definite shape at the Clyde Iron Works, as had been so completely and correctly described in the paper that had been read. The invention of the hot blast consisted solely in the principle of heating the blast between the engine and the furnace, and was not associated with any particular construction of the intermediate heating apparatus; this was the cause of the success that had attended the invention, and in this respect the case had much similarity to that of his countryman James Watt, who, in connection with the steam engine, invented the plan of condensing the steam in a separate vessel, and was successful in maintaining his invention by not limiting it to any particular construction of condenser. He was glad of this opportunity of acknowledging how firmly the English ironmasters stood by him in the attempts made in the early time of the use of hot blast to deprive him of the benefits of his invention; and to them he was indebted for the successful issue of the severe contest he had then to go through.

HELP FOR SEAMEN.

IT being pretty generally known that we include very many naval gentlemen and persons more or less connected with the navy among our readers, we are not unfrequently brought in contact with nautical affairs. Among other objects of interest the sailors' home and refuge for shipwrecked mariners, at Great Yarmouth, has lately come under our notice, and we think it not altogether beyond our duty to say a word in its favour.

In no part of the world are there so many shipwrecks as on the east coast of England. During the year there were no fewer than 600 casualties between Dungeness and the Pentland Firth; being more than 50 per cent. upon the whole number on the entire coast of the United Kingdom. This very large proportion is attributable to the vast number of ships passing and repassing along these shores. It is calculated that not less than 40,000 sail, exclusive of vessels engaged in our fisheries, annually pass and repass through Yarmouth Roads; most of them being engaged in carrying the produce of our collieries to London and other markets. This Roadstead is the only natural harbour of refuge on the eastern coast, and it is not uncommon to see many hundreds of vessels there at the same time; whilst on some occasions a long continuance of adverse winds, either way, will cause a much larger number to remain at anchor.

But Yarmouth Roads are surrounded by a a natural breakwater of very dangerous sands, which in foggy weather, or when heavy gales sweep the coast, occasion many fearful shipwrecks. During the last three years more than 500 vessels were stranded, wrecked, or lost off this coast, or compelled to put into Yarmouth harbour with damage. As a necessary consequence the loss of life is also great; and the number of shipwrecked mariners who are landed at Yarmouth, year after year, is very considerable. The benefits which "The Shipwrecked Fishermen and Mariners' Benevolent Society" has rendered at Yarmouth have long been gratefully acknowledged, but it has also been felt that something more was required. The survivors of a wreck or the crew of a foundered vessel, are brought on shore always wet and weary, frequently exhausted by cold and hunger—often more dead than alive. There was no place to which they could be carried but the public-house, where it was impossible to obtain, on the instant, those appliances which were so necessary to restore suspended animation, and such other remedies as circumstances required. To obviate this evil an Institution was founded at Yarmouth about twelve months since having for its object the social and moral improvement of the fishermen, beachmen, and seafaring population of the town; and combining the advantages of a sailors' home (so far as they are required here) and especially providing a place of refuge for the shipwrecked and destitute mariners of all nations. 288 shipwrecked and distressed mariners have already been received and relieved. Of this number 204 were British seamen and 84 foreigners of all nations.

The inadequacy of the present establishment has, however, been made most painfully apparent during the recent gales which have desolated our coast. In twelve days only, 109 shipwrecked mariners were brought to the Home, and relieved so far as the present limited resources would permit. In order, therefore, to meet the very urgent demands now made upon the committee it has been proposed to erect upon a most eligible site, fronting the sea, lately granted by the Town Council for the purpose, a building fitted with baths and all other necessary appliances, to which shipwrecked mariners can be brought at any hour of the day or night, and at which there will be the certainty of finding all things necessary to restore them to health and strength; and it is firmly believed that by such means many a valuable life (as has already been the case in three instances) may be saved. At a public meeting lately held in the town hall, it was determined to appeal to the humanity and generosity of the public generally to assist the inhabitants of Great Yarmouth in establishing an institution which may be considered as partaking of a national character.

The Mayor of Yarmouth, who has brought this subject to our notice, has generously offered to receive donations; and we doubt not many readers of ours will gladly aid a cause which, at the present time especially, deserves the good wishes of our countrymen. We hope we need not apologise for devoting a few lines to such an object.

IMPROVEMENT IN THE VOLTAIC PILE.

IT is well known that Bunsen's pile, which is but a modification of Grove's, consists of a glazed vessel, containing a cylindrical element of zinc, which surrounds a porous vessel filled with strong nitric acid, into which a charcoal cylinder has been introduced, the liquid in the outermost vessel consisting of water acidulated with about 10 parts of sulphuric acid. Now, although this is a most powerful combination, and in general use, it has two great inconveniences: first, the quantity of nitrous vapour it evolves is highly unpleasant, and may become dangerous; and, secondly, the current produced is not of constant intensity. M. Thomas has just communicated to the Academy of Sciences a modification which he has effected in this kind of pile, and which would seem to be quite free from the inconvenience alluded to. M. Thomas, in fact, shows that the development of nitrous vapour is one of the chief causes which interfere with the constancy of the current, inasmuch as they attack the copper ribands forming the electrodes, and effect certain chemical combinations, which give rise to counter-currents, and thus impair the principal one. He therefore causes these gases, as they are evolved, to pass into a porous vessel, where they are decomposed. In this process a secondary current is produced which, by the peculiar construction of the apparatus, is turned to account, and tends to correct the inequalities of the principal current. This arrangement also prevents the pile from becoming dirty, as is the case with Bunsen's pile.

COMPOSITIONS FOR COATING IRON SHIP'S BOTTOMS.—The following paragraph has been communicated to the morning papers:—"A number of gentlemen interested in shipbuilding assembled recently in the Southampton Docks, to witness the result of an experiment which had excited some interest among persons of that class. In the early part of last May the Royal Mail Company's steamship Atrato was coated on the starboard side with M'Innes's green copper soap, and on the port side with Peacock and Buchan's pink composition, for the purpose of practically testing the relative merits of the two articles in keeping the bottom of the ship clean. On docking the Atrato for examination it was found that the starboard side was covered with coral pipe, shells, and barnacles, with a good deal of corrosion; while the port side was perfectly free from coraline incrustation or barnacles, having merely a thin slimy unctuous coating upon it. The result is considered as having incontestably proved that preparations of copper are of little value in preventing incrustation or fouling on the bottoms of iron ships, while their galvanic action must, sooner or later, prove injurious to the rivets and plates. The green composition is now being scraped off the Atrato."

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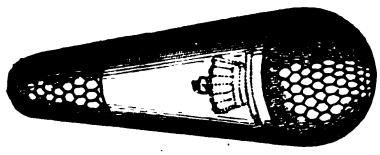
CAPTAIN NORTON'S GOSSAMER CARTRIDGE FOR SMOOTH-BORE GUNS.



THE above is a sketch of Captain Norton's gossamer cartridge, with spherical ball attached, intended to be used with smooth-bore shot guns, double or single, fitted with ordinary patent breeches, and so utilise arms of that description in case of emergency. The tapering form of the cartridge allows it to enter freely into the chamber so as to bring the small end as closely as possible to the communication from the nipple. Both the bullet and powder cartridge are covered with cotton net, and the stiffness necessary to preserve the general form of the completed cartridge is gained by pasting a strip of thin paper around it in such a manner as to leave each end exposed. Curtis and Harvey's improved "Large grain powder" has been found to be best suited to these cartridges. The net surrounding the bullet will retain any lubricating matter which may be preferred, and so facilitate loading and prevent leading of the barrel.

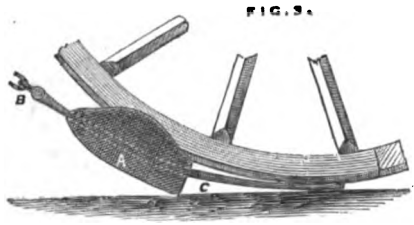
POUPARD'S IMPROVED WHEEL-SKID.

MR. WILLIAM POUPARD, Engineer, of the Blackfriars-road, Southwark, has lately introduced an improved wheel-skid or shoe, which many persons think highly of. He forms his skid with a tail piece extending backward from the wheel-chamber so as to form an inclined guide or path for the wheel to follow on entering the skid. This tail piece may be carried entirely through to the front of the shoe, and he prefers to form it of wrought-iron or steel, while the body of the shoe may be made of cast or wrought-iron. He finds the best results to be obtained when the projecting tail piece is curved upwards, but he does not limit himself to so shaping it. Fig. 1 of the

FIG. 1.

FIG. 2.

FIG. 3.

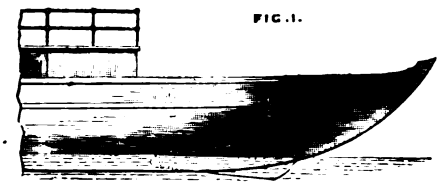


accompanying engravings is a side elevation of a wheel-skid or shoe, constructed according to his invention, and Fig. 2 is a section through the line *a b* of the same. *A* is the body of the skid or shoe, which is attached in the ordinary manner to a chain *B*; B^1 B^1 are sides or side pieces forming a chamber for the wheel; *C* is the tail piece, made by preference of steel or wrought-iron, and riveted or bolted to the body *A*, as shown by the dotted lines in Fig. 2. He prefers to form the tail piece of a curve to correspond with the contour of a wheel, but this shape can be varied without departing from the essential features of the invention. Fig. 3 shows a wheel just entering the skid; to provide for this raise the chain *B*, which brings the tail flush or nearly so with the ground, and allows the wheel to run in; let go the chain, and the wheel comes to rest in the skid. The improved skid is now being made in large quantities.

CHAPLIN'S STEERING APPARATUS.

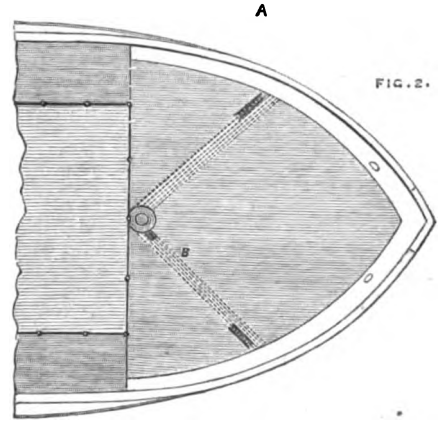
AT a recent meeting of the Institution of Engineers in Scotland, Mr. Neilson explained the construction and working of Mr. Chaplin's steering apparatus, several models of which were exhibited. The improved steering apparatus is more particularly destined for flat-bottomed boats of light draught for shallow waters. The steering is effected by means of vertical plates disposed obliquely at either end, or at both ends, of the vessel, in the manner shown in Figs. 1 and 2,

FIG. 1.



A

FIG. 2.



which are respectively an elevation and the plan of the stern of a boat fitted with the plates. There are two steering plates, *A*, one on each side of the vessel; and they work in vertical casings, the positions of which are indicated by dotted lines at *B* in the plan, Fig. 2. Each plate, *A*, turns on a joint at its front end, and when not required to turn the vessel to the side it is on, is drawn up within its casing. Independently of their peculiar suitableness for flat-bottomed boats, these plates have a greater control and act more quickly than the ordinary rudder, from their being placed on each side of the centre line of the vessel. A pair of the plates at one end is sufficient for ordinary requirements, whilst for intricate navigation a pair at each end may be used, to be actuated either simultaneously or separately.

Mr. Downie asked, at what angle the steering plates were set, and whether they had ever been practically tried; and, if so, with what result? Mr. Chaplin said that whilst various angles might be adopted, he preferred that of 37° from the line of the keel. The plates had been successfully tried. He understood that seventeen boats were being or about to be built in England with steering plates on the same plan as that described, being chiefly for the Government. On trying the steering plates in a small boat, it was found that when plates were acting on the same side at both ends, the boat turned round on a radius equal to its length. Another modification had been applied to a vessel built by his firm, and sent to Java, consisting of a simple conical shell oscillating on an axis, a piece being cut out of the cone, and one side or other being made to project as required; but this was only suitable for small vessels, where the apparatus was not to project through the deck. The vessels which he mentioned as in course of building were to draw 2 feet water, to carry 1,000 men, and coals for a voyage of 50 miles. They were 220 to 240 feet long, and 35 to 40 feet beam, and almost perfectly flat. They were, he understood, intended for the navigation of the Ganges, and other rivers of India. The steering apparatus was adapted as well for deep sea vessels as for those of shallow draught; and for screw vessels it was peculiarly fitted, for the screw could be fitted between the plates. In the event of any injury being sustained by one of the plates, it could be hoisted on deck without trouble and repaired. If the steering plates were projected, one at each end of the vessel on opposite sides, and so as to be parallel to each other, the vessel would move in a lateral direction, and would be easily brought alongside of a pier.

AULD'S APPARATUS FOR SUPPLYING STEAM BOILERS WITH WATER.

MR. DAVID AULD, of Glasgow, Engineer, has just patented the "automatic mechanical arrangement for the efficient supplying of steam boilers with water, so as to ensure both a plentiful supply and certainty of action," which is represented in the annexed engravings. Fig. 1 is a partially sectional elevation of one modification of the apparatus. Fig. 2 is a partially sectional elevation of another modification of the apparatus, in which the several parts are arranged in a somewhat different manner. In the first arrangement, Fig. 1, the water for the supply of the boiler flows into the apparatus from an elevated tank or reservoir through the feed-pipe which opens into the valve chamber *A*, the efflux of the water being prevented by the clack-valve *B*, which closes the entrance to the valve chamber upon the occurrence of back pressure on the water. From the valve-box the water flows into the chamber *C*, and thence upwards into the cup-shaped chamber *D* above; the chamber *C* has two flanged tubular openings in the lower part, which serve to connect the apparatus to the steam-pipe *E* and the pipe *F*, through which the water flows into the boiler *G*. The steam-pipe *E* is carried downwards into the boiler to the proper water level, and the water-pipe nearly to the bottom. The flow of steam through the pipe *E* is controlled by the valve *H* which is pressed up against its seating by the pressure of the steam within the boiler, and is prevented from falling away too far therefrom by the small bridge-piece *I*, which extends across the steam-pipe. The inlet to the pipe *F* is in like manner controlled by the valve *J*, which rests upon the bridge-piece *K*, during the time that the water is flowing into the boiler. The tubular seating of the valve *H* is made conical at the upper part to receive the lower extremity of the tube *L*, which passes up through the chamber *C* and *D*, and enters the copper globe *M*, terminating near its upper part. The tube *L* is fixed in position by the angular stays *N*, the lower bent extremities of which are bolted to the globe *M*, the bolts serving also to connect the globe to the short flanged pipe *O*, which slides loosely in the opening of the cap *P* of the chamber *D*. This cap is bolted to the flange of the chamber *D*, a diaphragm of india-rubber or other suitable flexible material being interposed between the faces of the flanges; the inner part of this diaphragm is held between the flanges of the pipe *O*. With this arrangement the water cannot escape, at the same time the pipe *O*, carrying the globe *M*, is free to slide up and down in the opening in the cap *P*. The globe *M* is formed in two parts which are bolted together, and at the upper part there is an eye by means of which it is attached to the chain *Q*, which is secured by a nut to the upper extremity of the segmental part of the balanced lever *R*. The segmental part of this lever is hollowed out like a grooved pulley, and at the central part of the lever there are laterally projecting knife edges similar to those of a scale beam. These knife edges rest upon a hardened steel plate, which is supported in slots made in the forked extremity of the pillar *S*; this pillar is carried upon an overhanging bracket cast on the side of the chamber *C*. To the outer part of the rocking lever *R* is fitted an adjustable counterweight *T*, which is fixed at the proper distance from the centre by the set screw *U*. Arching over the centre of the lever *R* and its supporting pillar is a bridge-piece *V*, which is bolted to the lever *R*; this bridge-piece has a segmental slot made in it, in which are fitted two

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AULD'S APPARATUS FOR SUPPLYING STEAM BOILERS WITH WATER.

FIG. 1.

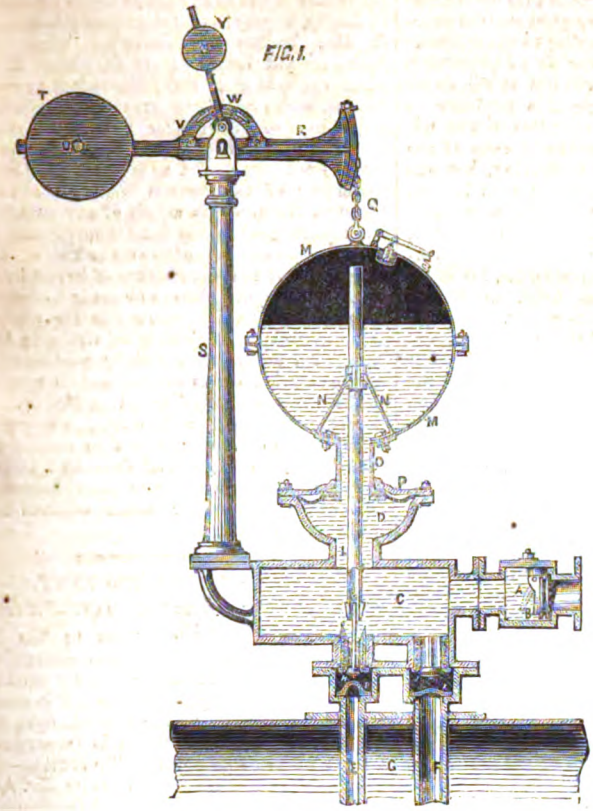
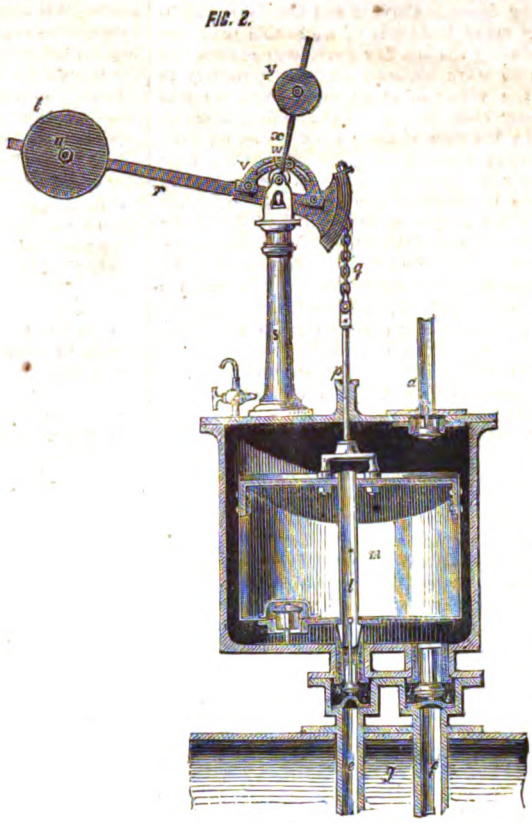


FIG. 2.



adjustable sliding stops *W*. These stops serve to check the lateral motion of the vertical swinging rod *X*, the lower end of which is carried on a stud fixed in one of the upwardly projecting ends of the pillar *S*; at the upper part of the rod is fixed the weight *Y*, which is fastened thereto by a set screw. The weight *T* is fixed at such part of the lever *R*, so that it counterbalances the weight of the globe *M* and its appurtenances, together with a certain quantity of water in the globe, the upholding action being assisted by the overhanging weight *Y* on the rod *X*. As the water flows in from the supply-pipe and up into the globe *M*, when it reaches a predetermined height therein, the accumulated weight overcomes the gravity of the weight *T*, so that the lever *R* turns upon its centre, and the weight *Y* is thrown forward against the right-hand stop *W*; this action facilitates descent of the globe *M*, the short pipe *O* descending into the cup-shaped chamber *D*, at the same time the transverse pin at the lower part of the tube *L* comes in contact with the upper end of the spindle of the valve *H*, and the end of the tube enters the conical part of the tubular valve seating. The depression of the valve allows the steam to pass up the tube *L* into the globe *M*, its pressure causing the air valve *Z*, which is otherwise kept open for the egress of the air as the water flows up in the globe, to shut. The pressure of the steam on the surface of the water in the globe causes the valve *J* to open, and the water flows down the pipe *F* into the boiler, the steam pressure serving also to close the valve *B*, which prevents the water being forced back through the feed-pipe. The inflowing of the water into the boiler continues until the globe *M* is so far reduced in weight that the counterpoise *T* is sufficient to overcome its gravity and that of the weight *Y* in its overhanging position to the right of the centre of the lever *R*. When this takes place the globe *M* is raised by the motion of the lever *R*; the valves *H* and *K* are closed by the pressure of steam in the boiler, and the apparatus is again restored to its normal position. In this manner the due and effective feeding of the boiler is kept up with unerring certainty, the filling or partial filling of the globe, and the discharge of its contents into the boiler being regulated according to the evaporative power of the boiler.

In the modification shown in Fig. 2 the water from the overhead tank or reservoir flows through the vertical feed-pipe *a*, the lower part of which is closed by the valve *b*, which opens into the cast-iron water-chamber *c*; this chamber has fitted in the upper part a cock *d*, for the discharge of air from the chamber as the water flows into it from the feed-pipe *a*. The lower part of the chamber *c* is cast with two flanged tubular openings, by which the apparatus is attached to the steam-pipe *e* and feed-pipe *f*, which project out above the boiler *g*. The steam and feed-pipes are fitted with valves *h* and *j*, which when open rest on the bridge-pieces *i* and *k* in manner similar to the arrangement of the corresponding parts in Fig. 1. The spindle of the valve *h* is prolonged upwards so as to enter the lower extremity of the tube *l*, which is fitted in the centre of the cylindrical vessel *m*, the upper part of the tube being held in position by the transverse stays *n*. The vessel *m* is by preference made of copper, and it has at the lower part a valve *o*, by means of which the contents escape into the chamber *c* when the valve spindle comes in contact with the bottom of the chamber. The vessel *m* is connected by means of the bridge-piece and rod *p* to the chain *q*, which is attached to the segmental extremity of the rocking lever *r*. The arrangement of this lever and the parts connected therewith are in all respects similar to the corresponding parts delineated in Fig. 1, and do not therefore require further description. The water from the tank or reservoir flows through the pipe *a*, and falls into the vessel *m*, which when nearly filled descends to the position shown in Fig. 2, the descent causing the valves *h* and *o* to open. The steam having now free ingress to the chamber *c* through the tube *l*, its pressure closes the valve *b*, and acting upon the surface of the water, the valve *j* is opened, and the water flows into the boiler *g* through the pipe *f*. The flow of water continues until the weight of the vessel *m* is sufficiently reduced to admit of its being raised by the counterweight *t*, and thus restored to its normal position. The upward motion of the vessel *m* is followed by the opening of the valve *b*, and the closing of the valves *h* and *j*, and the self-acting operation of refilling the vessel *m* again goes on.

"By means of either of these modifications of my improved automatic feed apparatus," says Mr. Auld, "the due supply of water to boilers is most efficiently provided for, at the same time the simple arrangement of the several parts almost precludes the possibility of derangement."

CLAYTON'S PATENT BRICK AND TILE MACHINERY.

WE have been invited, prior to the opening of the Smithfield Club Show, to inspect the working of some brick and tile machinery just completed by Messrs. H. Clayton and Co., in accordance with their several patents, and which machinery will be exhibited in motion during the continuance of the show, partly in Baker-street, and partly at Messrs. Clayton's Atlas Works, Upper Park Place (within a few minutes' walk of Baker-street), where alone the larger machines can be shown; the space procurable in the Baker-street building being too limited to admit of the exhibition of any of the machines, excepting one worked by hand power, but which is yet capable of turning out several hundred bricks an hour, whether solid or perforated, or a proportionate quantity of tiles, drain pipes, or similar articles. Before describing in detail the late improvements made in Messrs. H. Clayton and Co's machines, we think it well to observe that much credit is due to these gentlemen for their untiring perseverance in introducing modifications in the details of their machines, which extended practice has from time to time suggested, and is ever certain to suggest when there is any disposition to profit by experience. The principle of "leaving well enough alone" is doubtless, as regards many things, a very safe one, especially when changes are made, as it were,

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hap-hazard for the sake of appearances, rather than from any real desire to attain perfection; but this principle would appear to be held in very light esteem by Messrs. Clayton and Co., for notwithstanding many hundreds of admirable machines having during the last few years been constructed and set to work by them, sufficiently perfect to satisfy the wants of those using them, we find every year changes made in their details which evince on the part of their constructors an absolute mastery over the subject which they have made their special study—changes perhaps hardly noticeable by casual observers, but which, nevertheless, when cost of construction and durability are concerned, are of the very highest importance, and deserve, especially at our hands, a careful investigation and favourable notice. To make a machine which will sell, and to call it the best that is made, is one thing; but to make a machine really as well as it can be made before it is offered for sale, is quite another thing, but one which we fully believe Messrs. Clayton and Co. always attempt to do.

The points to which we now more especially desire to call the attention of our readers, relate first to the mode of driving the "roller" dies of the brick machines. Until recently these dies were driven *continuously* by means of straps, that is, they were in motion both when the clay was being passed through or rather between them, and also when the clay was stationary, which caused them to be unnecessarily worn by their rubbing against it. Besides this, the straps frequently slipped when accidentally wetted by the water used for lubricating the surface of the dies, which caused the dies to travel at different speeds, and which, to some extent, was injurious to the perfect formation of the clay. The roller dies are now, however, driven by bevel-gearing, which is carefully boxed up in order to keep it clean, and which is actuated at proper intervals only (when the clay is in motion) by a cam and lever worked from the main shaft. Again, the dies which are covered with a porous material (kept moist and clean by water supplied both to its back and face) were formerly *entirely* so covered, about one inch both at top and bottom continually rubbing against the ends of the upper and lower fixed dies, and which caused comparatively rapid wear. This evil is now got over by encircling the roller dies with brass hoops at top and bottom, leaving the covering material only exactly deep enough to equal the thickness of the brick. Lastly, the foundation of these roller dies on which the coating is lapped is now made of white metal which does not oxydise, even although the machine lies idle for several months, but which would immediately result from the contact of the wet covering with the rollers were they of iron. We now pass on to improvements made for ensuring an uniform tension of the cutting wires. Formerly a rigid bar carried the end of these wires, which were quite independent of each other, and were tightened up by hand as equally as possible; now, however, nearly perfect uniformity is secured by fixing the carrying bar rigidly at one end only, that is, by bending it at that end in the form of a right angle, and then by the tension produced in the wires, bringing the other end (fitted with a friction roller) down about an inch until it rests upon a curved cross-bar, and upon which the friction roller travels as the wires are moved from side to side. Another matter which we may here mention is, that the small pinions used in these machines are cut out of solid blocks of wrought-iron, instead of being cast. The importance of this can perhaps be appreciated only by those who have worked machinery subject to the same rough usage as brick machinery is, and more especially when worked abroad or even in some home districts where repairs cannot be readily effected.

Before concluding we would for a moment allude to the various attempts made to manufacture bricks from dry clay, by means of pressure. This mode of manufacture has been favourably looked upon in some quarters, from the idea that a considerable saving both in time and money could be made from the bricks requiring no drying previously to be being burned; but it has been completely overlooked that quite as much if not very much more time and expense are involved in preparing that clay before it is made into bricks, this preparation really necessitating great storage room, besides being very difficult, owing to the necessity for just so far drying the clay as to prevent it adhering to the moulds, and yet not so far doing it as to deprive it altogether of a tendency to cohesion amongst its particles. Space will not admit of our discussing the pros and cons of the dry and wet principles of brick making, but one point strikes us very forcibly, and that is that, from what we have seen the dry process requires very powerful, heavy, and expensive machinery, costing to the tune of £3,000 or £4,000, for making say 20,000 bricks per day; whereas, for about one-sixth of this sum wet brick machinery can be had of equal productive power. In other words, by the expenditure of the above sum, wet brick machinery may be procured (even after allowing for additional labour) of five times the productive power of that for making bricks on the dry process. The problem Messrs. Clayton and Co. set themselves to work out was—to make a clean and perfect block of plastic clay; and the product of their machines is assuredly the Q.E.D. It would be quite impossible in a notice like the present to do more than hint at the various machines Messrs. Clayton and Co. construct, suitable for manufacturers of bricks, either on a large or small scale, whether the machines be driven by steam, water, animal, or manual power, and whether intended for solid and hollow bricks alone, or for these as well as tiles, drain-pipes, and similar articles. Suffice it to say, that at the present time, having devoted considerable time to the subject and had much experience in fitting up brick manufactories, these gentlemen are enabled to supply all and every requisite for the thorough organisation of brick or similar clay ware works, including plans for the laying out of the works, the construction of the kilns, drying sheds, &c., and, moreover, advise on the selection of the sites for the erection of the works themselves. The production of "bricks, whole bricks and nothing but (good wet) bricks," has been the form of asseveration made by Messrs. Clayton and Co., any day these last five and twenty years, and as brick and tile masters they still stick to their "leather." Of machines lately ordered of Messrs. Clayton and Co., we may mention as many as twenty for the Government for India, while of those now exhibiting one is for Prince Bariadinsky, another for Prince Potenkin, and a third for Prince Demidoff for his mines in Siberia. There is also a large machine for Venice, and an order of some 20 machines is shortly to be completed for Bombay. With respect to special machines we must not omit to notice the new one for the manufacture of very large drain pipes or gas retorts. This machine is so constructed that the core or piston is not supported by any cross-bar, which would of course divide the stream of clay issuing from the machine, and which strain would not completely unite in a short distance, thus causing the pipes to crack; but the core or piston is suspended from a long rod attached to the upper part of the machine, thus leaving the clay undivided in its way through the die plate. Several of these machines are at work. We may also mention an ingenious machine for making extra finished bricks by placing ordinary bricks when in a moist state under pressure (about 3 tons) given by a bob lever and weight worked by hand, and which puts a fine polish on the surface of the bricks, besides stamping any device upon them if required. The mould is in this case kept lubricated by a layer of cotton saturated with oil, being placed between two plates which together form the lower piston of the mould.

We regret to learn that many of the improvements really invented and patented by Messrs. Clayton and Co., and so successfully introduced into their brick machinery, have like many other good things become imported into the productions of rival manufacturers so soon as their success has been established, and it has even happened that prizes at our agricultural shows have been, perhaps unwittingly, awarded to those who have simply adopted Messrs. Clayton and Co.'s principles in the construction of their machines.

Lastly, we may as well state that Messrs. Clayton & Co., besides manufacturing brick making machines and brick factory fittings of all kinds whatever, have successfully introduced a green crop mower, which has given great satisfaction. The guide bars of this mower are very beautifully formed in the shape of the letter Y, the upper portion not being solid as is usually the case, but consisting of two prongs with an open space between them, which allows of any matter which becomes clogged to free itself immediately and so preserve the cutting edge of the knife. We will only add that the manufacture of bricks by means of the various machines now made to facilitate it (not forgetting an ingenious one for ridding the clay of stones by a process of straining the clay through a comparatively finely perforated plate) may be carried on as cleanly and as comfortably as the manufacture of bread *might* be. Those horrid red-headed and dusty, unrecognizable individuals so frequently seen in ordinary brick fields are fast going out of date, and their places supplied by others much more human in appearance, who can perform their labour without literally wallowing in the mire.

STEAM-SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—The objection to the formula which Mr. Atherton and the committee of Section G of the British Association have adopted as the test for economical performance in the steam mercantile navy, rests on the ground, first, that the ⅔ power of the displacement is improperly employed in place of the midship section—for that this is its purpose is now avowed by Mr. Atherton—such factor being an imperfect factitious substitute thereof, a mere mathematical expedient in lieu of the reality. It is true, as suggested by Mr. Atherton, that the one will be as proper as the other, or that the midship sectional areas will vary exactly with the square of the cube root of the displacement, *when* the bodies immersed are similar in form and general proportions; but it is precisely because vessels are dissimilar in those respects that any formula is of any use at all beyond determining the comparative efficiency of propellers, engines, and boilers, instead of the comparative merits in the build of ships, and beyond ascertaining the effect of mere size. The formula in respect to its ostensible existence commits through its accuracy a *felo de se*. Even as to its remote and limited ability, there would exist no reason for preference, no difference in result between the formula in terms of midship section or in terms of displacement, if this statement of substitution and identity be accepted. That Mr. Atherton should have conceived the possibility of my "questioning the geometrical fact" on which the substitution is founded, could only have arisen from the printer's error, of making me say that the ⅔ power of displacement is a fictitious instead of a factitious thing; but of course your correspondent does not require to be told that such substitution must necessarily be false and misleading, when the condition for the truth of the "geometrical fact" is wanting, namely, that the bodies be similar. So much for the erroneousness of the formula as being based on the midship section "in terms of the displacement."

But secondly, and principally, the objection to it rests on the ground of its being wholly inappropriate to the purposes which it professes to serve among merchant steam-vessels, namely, to test their carrying capacity in relation to speed and power; and this objection is equally valid, although we base the formula on the true midship section, instead of making the ⅔ power of the displacement do duty for it. All the information that can be obtained by it is the velocity in relation to power when the area of resistance is constant, or the area when the velocity is constant, of which the only item that is useful is the

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velocity. The carrying capacity in combination with speed is completely ignored, nor can it even be conjectured from the midship section, for the one might augment, or it might diminish, with the augmentation or with the diminution of the other. What, then, is the use of this formula as applied to merchant vessels in their character of transports of merchandise? Mr. Atherton says that I "admit the applicability of the formula based on the midship section," which I certainly do, but only for the pupose I stated, namely, of obtaining the comparative worth of the lines of vessels through the velocities attained with a definite amount of power, and consequently the comparative worth of merchant-ships, in their character as passenger vessels primarily. Here the useful effect contemplated is merely velocity, and this the formula indicates, and this alone; but if we would view it and value it conjointly with the amount of goods carried, we must approximate thereto through a formula based on the displacement simply, as I have heretofore explained. Indeed I cannot think that the author of the formula under animadversion, whoever he is, intended merely "to express the midship section in terms of the displacement," but wished, although making a *muddle* of the thing, to mix up with it the element of tonnage. Mr. Atherton does not attempt to defend the appropriativeness of the formula; would it not then have been as well to have acknowledged at once that it is indefensible? I beg to assure him that I intended exoneration, and not an inuendo, by saying that from what I could understand he was not the author of it. It seems I might have learnt in his own writings that he has disclaimed any such honour, but I have not had the pleasure of other acquaintance with them than through your pages.

Yours, &c., BENJAMIN CHEVERTON.

UNSINKABLE SHIPS AND RAFTS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Mr. Atherton evidently imagines that in proposing to construct unsinkable ships he has made a valuable discovery. He seems, however, to be satisfied with the principle, apart from any consideration as to the obstacle which may stand in the way of its being practically applied; and he leaves to others the task of maturing the invention, so that vessels may be built which will defy shot and shell, wind and waves. I presume that those who will succeed in fulfilling these requirements will deserve as much credit as the inventor; possibly, however, Mr. Atherton will compete for the prize which is to be offered by the Society of Arts, and consequently may succeed in keeping all the credit to himself—and which he will most certainly deserve. So far, the invention has been but vaguely defined. In the first place, we are favoured with a ship which is to be a solid mass up to the water line; and that such a ship would float under all circumstances, there is no room to doubt; but what have we to prevent it from floating keel upwards? and from sending its dead and living cargo into the depths of the ocean? We have an answer, or that which may be supposed to be intended as an answer, from Mr. Atherton, in the form of an explanation, in the last number of the MECHANICS' MAGAZINE;—the machinery is to be placed below the water line. This I suppose includes the boilers, fuel, &c. Perhaps it will also be found essential to make room considerably below the water line for the powder magazine; for shot and shell; and by this time we shall find the ship, the *solid* mass, tolerably well ballasted. But will he not admit the necessity of scooping out of the mass a spacious "cock-pit," in which the surgeon will be in no danger of having his head knocked off by a stray shot, while amputating the limb of a naval hero?

Clearly there is no necessity for building new ships before adopting Mr. Atherton's invention. In order to test its value, all that is required is to select a line-of-battle ship—an old hulk; let the hold up to the water line be filled up with some light, water and fire-proof substance, with the exception of the spaces above enumerated; then let the attempt be made to scuttle it during a gale, fifty miles S.W. of the Land's-end, and if all attempts to do so should fail, then, and not till then, will Mr. Atherton have proved the practicability of adapting his invention for purposes of naval warfare.

I have been engaged during some time in attempting to discover a plan for saving not ships, but human life, when the destruction of a ship becomes inevitable. The small boats usually found even in large vessels are, in nine cases out of ten, useless. They founder, or are dashed to pieces against the ship, as soon as they are filled with human beings. The plan which I propose as a substitute for existing arrangements, is applicable to all existing ships, without incurring any great expense. I would suggest that every ship should be furnished with an upper moveable deck, which could be unshipped, and made to answer the purpose of a raft. This deck-raft, if I may so term it, would be fastened to the ship only by means of screw-bolts, which could be easily removed, but as the masts would pass through it, it would at all other times form an immoveable portion of the vessel. The bulwarks might be connected with the upper deck, but the rigging would be fastened to the ship. After losing all hopes of saving a vessel, the masts and rigging would be cut away, the screw-bolts removed, and the deck raft entirely disconnected from the hull of the vessel; the waves would soon set it afloat, and it might prove a life raft capable of saving hundreds of lives. In the loss of the Royal Charter, we have a melancholy instance of the want of provision for saving life; and such tragedies may be soon repeated, for cool heads and clear judgments are not always the attributes of commanders of vessels. The form of a vessel causes it, on drifting, to strike aground a few hundred feet from the shore; and it is in that narrow space of water that thousands of lives are annually lost. Is it too much to assert that had the Royal Charter been furnished with a deck-raft none on board would have perished? I think not. Several hours passed between the ship being run on shore and her breaking up. This would have allowed the raft to be unshipped, and the passengers to be transferred to it; when being flat, it would have been thrown by the waves within a few minutes high upon the beach.

In the case of large vessels, more especially steamers, I would construct the deck-raft in two sections, the division being near the funnel. This would give great facilities for launching it on the waves, and in many instances one section only would be required. The raft should, of course, be constructed as firmly as any portion of the vessel, but as it would form the real deck, the planking beneath might be thinner than usual. As, however, it would be essential that water should never percolate between the two, I would propose to fasten some waterproof substance on the under part of the deck-raft. Vulcanized india-rubber, or kamptulicon, would be unquestionably the best, but the cost might be too great; and in that case, a rope matting saturated with tar might be used—or better still some light, cheap, water and fire-proof substance, not yet discovered; but in the discovery of which we may receive some valuable assistance from the Council of the Society of Arts. Such a deck would be valuable, independent of its ever being required for saving life, as it would muffle the sounds caused by dragging chains and heavy weights—sounds so disagreeable to passengers, as any one who has passed a few nights at sea during a gale can testify. Various modes of constructing the raft will suggest themselves to ship-builders, so that it might be converted into a ship should occasion require; and I hope that the idea will not be altogether discarded unless a more effectual plan can be devised for preventing the loss of so many valuable lives, frequently within a stone's throw of terra-firma.

I believe Mr. Atherton's invention admirably adapted for fishing-boats, but in its present form, it is not worth much. If his ambition will condescend to take a sufficiently humble flight, and mature his invention, he will accomplish as much as if he had built an unsinkable frigate. It would prove invaluable to many brave fellows who pass their lives on the ocean, too many of whom find in it a grave.

I remain, gentlemen, very respectfully,
JOHN DE LA HAYE.

Perth, November 18th 1859.

SAILING.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Suppose two ships sailing in the same direction, with a strong gale on the quarter, one of the old form aptly described as being built by the mile and cut in lengths, the other of the modern clipper form. The former is under reduced sail and goes ten knots, the latter carries on and goes eighteen knots; the spars of the former bend as though another foot of sail would break them, the latter shakes out the reefs as she gathers way, and sail is added without danger to the spars. If the pressure of wind at the time is ten pounds per square foot of stationary surface, the pressure on the former ship's sails would be about six pounds per foot, while the clipper's sails would only have to sustain 1·6 pounds per foot, her speed reducing the actuating force to that extent; and this accounts for the fact that captains of clipper ships carrying such a press of sail as they do in favourable gales, every foot of canvas added reducing the surface pressure, and adding to the speed without unduly straining the ship.

Two yachts of equal dimensions, differing in form, but of equal spread of canvas, sail a match. It is generally supposed that such a match is a fair one, and that they both carry the same *power*. This, however, is a mistake, and it is, in most cases, very unfair to the fleetest of the two, for she has to win the match with less power than the slower vessel, for the reason shown above.

Supposing, then, that ships are provided with ample canvas for favourable winds, with steam-power for calms and light winds, still there remains the fact that heavy adverse gales may and do arise when steam and sails are almost useless. When I heard of the wreck of the Royal Charter, I pictured to myself a large ship in this very position; yet I could not help thinking that the hurricane which proved such an enemy to her might, by suitable means, have been converted into a friend.

Reverting to my first illustration, it is evident that the two vessels can carry canvas in the proportion of 1 to 3·75 with the same amount of strain on each, and the effective horse-power used in propelling two ships may be represented as 1,000 in the case of the slow vessel, and 1,800 in that of the clipper.

It is evident, therefore, that to obtain great power from the wind a certain amount of speed of the propelled surface is necessary. A ship in a hurricane with a dangerous shore under her lee cannot, as ordinarily rigged, carry sufficient sail to realise the power to gain an offing; yet power is to be had in abundance, and to apply this power revolving vertical wind-screws* should be used capable of ready hoisting and lowering, and geared to either screw or paddle-wheels, by which an immense and cheap power can be applied, eclipsing both steam and ordinary sails, when working to windward in heavy gales.

I have made some calculations upon the subject, and I think that no vessel thus fitted need be lost on a lee shore; in fact, a head-wind may be regarded as a very valuable propelling power, instead of a hindrance to a vessel's progress. I propose that the wind-screws should be made to take a convenient form for housing on deck when not in use.

Suppose the Great Eastern to be thus fitted, I should make the radius of the wind-screw 40 feet, the pitch 120 feet; the screw could be lowered on deck and housed in a house built across the deck 81 feet long by 10 feet wide and 6 feet high, and could be hoisted in about 15 minutes. In a wind producing a pressure of 33 lbs. per square foot of stationary surface, every square foot of this screw

* Many persons would call them wind-*mills*, but the word *mill* is inapplicable.

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would produce about ¾ of a horse-power, and, as the Great Eastern could conveniently carry 3 such screws, from 5,000 to 8,000 horse-power could be obtained without burning a pound of coal.

I do not claim to be the inventor of "windmills on deck," the plan was patented so far back as 1709, and most of the subsequent patents (many of them very absurd) are therefore wanting in novelty, and void. The plan is open to all, the wind is a cheap motor, the safety of lives and ships is important, and I believe the adoption of this mode of using adverse strong winds would greatly reduce the chances of shipwreck, and with it the cost of insurance, and tend to increase the speed and economy of transit.

I am, Gentlemen, your obedient servant,

T. MOY.

1 Clifford's-inn, Nov. 22, 1859.

MEANS OF RETARDING RAILWAY TRAINS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—In last weeks MECHANICS' MAGAZINE a letter appeared from Mr. Alexander Allan of the Scottish Central Railway, disclaiming the invention of the throttle in the blast pipe of the Locomotive Engine, and awarding the whole merit of its introduction into this country to Mr. Rudolph Bodmer, of London. I cannot suffer that statement to pass without calling attention to a letter I wrote on the subject, signed "A Constant Reader," and which appeared in vol. 14, of the MECHANICS' MAGAZINE, No. 383, and dated December 11th, 1830. As many of your readers may not be in possession of the Magazine of that date I give copy of the letter:—

"MEANS OF STOPPING LOCOMOTIVE ENGINES.

"SIR,—A few years since an accident happened at a colliery where I was the engineer; the break that runs up against the fly wheel broke, and it was not in my power to stop the engine in time. A few weeks after I put a throttle valve to the eduction or waste pipe, where the steam escapes, and by shutting both throttle valves together I managed to stop the engine immediately. The moment the steam in the cylinder could not get out, the engine ceased to move. Now, Mr. Editor, might not a contrivance of a similar kind prevent such melancholy accidents as that which befel the lamented Mr. Huskisson at the opening of the Liverpool and Manchester Railway. I am aware of the momentum acquired by an engine in motion, and I do not say the means here suggested would meet that difficulty, but we are bound to do all we can to lessen the chances of such disasters; and I am sure that were the steam only brought under such perfect subordination, those chances would be reduced tenfold. Your insertion of these brief hints will much oblige,

"Your obedient servant,

"A CONSTANT READER."

Since the above letter appeared the adaptation of the throttle valve to the blast pipe has been patented by Mr. Booth, of the Liverpool and Manchester Railway, whose attention I then called to the invention; it appears also to have been since re-patented by Mr. Bodmer and Mr. Allan. Neither the invention nor its application is due to any of the three before-named gentlemen, but to your obedient servant, J. HOPKINSON, Engineer.

Britannia Works, Huddersfield.

STEAM ROCKET PROPELLER.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—Will you allow me a little space to reply to inquiries of readers of the MECHANICS' MAGAZINE?

The steam rocket at a pressure of 1000 lbs. per inch will, I believe, give more propelling power than any marine engine from the same amount of fuel. The rocket tube might be formed of the required strength by being made of small diameter, and of a roll of metal welded together, or of thin tubes fitting tightly one over another, and to allow for the expansion of the metal each tube should be put on hot. The recoil of a gun is caused much more by the velocity and expansion of the discharge than from its immense pressure. Steam at one-tenth the pressure has at least ten times the velocity and expansion of the gases from gunpowder; this difference arises from the greater elasticity of steam. Atmospheric air under the same pressure would have greater velocity and expansion, although not approaching to that of steam, water on the other hand being non-elastic would have less velocity, and, of course, no expansion, and therefore a discharge of water is greatly inferior to steam as a method of propulsion. Inattention to the differences in velocities of gases and their expansion is, I believe, one of the principal reasons why carbonic acid has not hitherto been worked to a successful result as a motive power. A steam rocket of 1 oz. propels a boat of 7 ft laden with 20 lbs. With a properly constructed vessel I have no doubt a speed of 30 miles per hour may be obtained in smooth water.—Yours &c.,

JAMES PARKER.

Camberwell.

LONDON SEWAGE.

THE following letter explains itself, and deserves attention:—

TO THE EDITOR OF THE "TIMES."

SIR,—As none of your correspondents have questioned the statements made by Mr. George Shepherd, C.E., in his letter on the value of sewage to the farmers, inserted in the *Times* of the 16th inst., I would be glad if you would allow me to make a few observations. The matter is important inasmuch as the determination of what is to be done with the sewage entirely depends on its value.

Mr. Shepherd says: "It is a fact that 750 tons of the rich sewage of London can be delivered to a distance of 100 miles round London, and on every farm included in that area, at a less cost than the farmer is now paying for 1 ton of guano, while the 750 tons of sewage contains more fertilizing matter than 5 tons of guano."

If this were really the case our prospects for the utilization of sewage—as it is—by the farmers would be very hopeful indeed, but I am sorry to say it is far from the truth. According to Drs. Hoffman and Witt, whose report on the nature, properties, and value of sewage, is the latest and best (published in the blue-book on the main drainage), the value of 100 tons of London sewage is only 17s. 7d. or a fraction over 2d. per ton, so that it would require 1,700 tons of sewage to replace 1 ton of guano. It follows from this that instead of 750 tons of sewage containing more fertilizing matter than 5 tons of guano, it only contains matter equal to about 9 cwt. The question which next arises is, at what rate or price can 1,700 tons of London sewage be delivered to the farmer at say 10 or 20 miles distance so as to replace 1 ton of guano which costs him £15 per ton? Again, can the sewage be delivered to the farmers at less than 2d. per ton, at say 10, 15, or 20 miles from London? If so, for how much per ton can it be delivered? There are other very pertinent questions which might here be put, but I do not wish to take up too much of your space; and besides, it will be as well to obtain satisfactory answers to the above before proceeding further. It is necessary to repeat that this subject is very important, but the adoption of sewage as a manure must after all depend on its value as a fertilizer, and on what it can be delivered to the farmer for.

I remain, yours, &c.

C. F. O. GLASSFORD.

Greenwich, Nov. 22, 1859.

The Vicomte Marie de Botherel, who died the other day in very straightened circumstances at Dinan, formerly possessed a large fortune, but got rid of it all through his unquenchable love for commercial speculations. His chief folly was the building of an immense establishment, including 15 kitchens, and starting omnibus restaurants: 12 of these vehicles carried hot viands, and 12 cold, all over the city; while 24 more supplied all Paris—or would have done so—with wine and liqueurs. He lost all his fortune by this freak except 260,000 fr., and this he got rid of in a very short time as a wine merchant on a gigantic scale. He has left behind him a work, in 4 vols., on "Human Infirmities!!"

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

THE APPEAL.

SINCE our last notice on this subject the following sums have from time to time been received, viz., T. B., £1; J. N., 10s.; J. T. 5s.; H. O., 2s. 6d.; H. B., 2s. 6d. For each and all of these we have to express the warm thanks of the receiver.

[ADVERTISEMENT.]

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Scottish Central Railway, Locomotive Department, Perth, November 21, 1859.

DEAR SIRS,—Will you oblige me by inserting in your two next numbers that I do not claim the Originality of the Throttle Valve in the Blast Pipes in Locomotive Engines, as a means of retarding railway trains, though patented by me: for, since I did so, I have found it previously patented by Mr. RUDOLPH BODMER, of London, to whom any merit is due in introducing it in this country.

I am, dear Sirs, yours truly,

ALEX. ALLAN.

Law Cases.

CURTAIN'S PATENT CARPETS.

COURT OF EXCHEQUER, Nov. 30. (*Sitting at Nisi Prius, at Westminster, before the Lord Chief Baron and a Special Jury.*)

CURTAIN *v.* CROSSLEY AND OTHERS.

Mr. Huddleston, Q.C., Mr. McNamara, and Mr. George Shaw were counsel for the plaintiff. Mr. Atherton, Q.C., Mr. Montague Smith, Q.C., Mr. Grove, Q.C., and Mr. Aston appeared for the defendants.

This was an action brought by the plaintiff, who is the patentee of certain improvements in the manufacture of carpets, for an infringement of his patent by the defendants, who are the well known carpet manufacturers at Halifax, in Yorkshire. The infringement complained of was the using by the defendants of a wire with a bladed end for cutting the pile of Brussels pile carpets in the course of their manufacture in the manner pointed out by the specification of the plaintiff's patent. It was shown that the old method of cutting the pile could not be applied to power looms, and there was no question as to the fact of the defendants having used the bladed wire. For the defence it was proved that wire constructed on the same principle as that used by the plaintiff had been used in the manufacture of pile carpets, velvet, and velvet lace anterior to the date of his patent. An extract was read from the *Dictionnaire des Arts*, published in Paris prior to the plaintiff's patent, and sold in London, describing the raising of the pile of Gobelin tapestry by a process similar to that employed by the plaintiff in his manufactures under his patent.

After Mr. Atherton had summed up his evidence, and Mr. Huddleston replied upon the whole case.

The Lord Chief Baron, in the course of his summing up, told the jury that if they believed the witnesses called for the defendants, they must find their verdict for them.

The Jury found a verdict for the defendants.

TUCK'S PATENT PISTON-PACKING.

COURT OF QUEEN'S BENCH, NOV. 30.—SECOND COURT. (*Before Mr. Justice Blackburn and a Special Jury.*)

The Court was occupied the whole day in the trial of "Tuck *v.* Silvers," for the infringement of a patent for packing the piston-box of steam engines.

Only six special jurors answered, and the remainder of the panel were fined 5*l.* each for non-attendance.

Mr. Bovill, Mr. Lush, Mr. Wilde, Mr. Webster, and Mr. Hindmarch appeared as counsel in the case.

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Our Weekly Gossip.

AN American gentleman, Mr. Germain, of Buffalo, proposes to build a ship 4000 feet long, 70 feet broad, and having a long steadying fin 20 feet broad on each side of her. She is to be so sharp forward that she shall taper only 6 feet in 100. The fins are to be as deep as they are broad, and to taper off to nothing in the last 500 feet. The extreme end of the vessel is to be an upright wedge, with a sharp edge. Twenty-five feet of the aft end is jointed for a rudder. The fins moving continually in water, can be used for surface condensers, and having the air pumped out and the steam exhausting into a vacuum, the locomotive engine may be used with the advantages of a condensing engine. The bottom and side walls are double, with their outer and inner surfaces three feet apart, tied together once in three feet by iron walls, and braced diagonally with timbers. Each compartment is to be water tight. The decks are to be of iron. "Careful calculations show," he says, "that the greatest oceanic forces will not try the strength of the vessel in any way to exceed ten per cent. of its strength. A side wind of twenty three miles an hour will careen it less than two inches, and a tornado of one hundred miles an hour, striking the whole side with a force of fifty pounds to each square inch of surface, would careen the vessel only thirty-eight inches, or less than five degrees. If steel is used for its construction, it would give twenty-five acres of deck room. Compared with other vessels and their work, its expenses would be exceedingly moderate, and at the same time it might carry two hundred thousand horse-power. Its size, strength, and velocity would make it irresistible by ordinary vessels of war. Cannon shot would glance unharmingly from its oblique sides; during its approach it would be directed with the precision of a rifle, and its blow would divide the largest line-of-battle ships as easily as a broad axe would an apple." Where is the Great Eastern now?

We do not remember to have said anything to provoke the following curious letter:—

London, Nov. 25, 1859.

GENTLEMEN,—It has been stated in a public company that you had in the MECHANICS' MAGAZINE alluded to my inventions or system of telegraphing on the ocean or land by means of colours during the night or by day and that my Lords of the Admiralty had paid me for them before using them on her Majesty's ships of war. Now, as this statement has been made by the trickery and deceit of those creatures who abound about the Admiralty connected with the press, I beg to state that no payment has ever been made to me directly nor indirectly for this invention, nor any compensation whatever; and so far from doing that they in the most dishonest way have taken the advantage of all my inventions, because I was poor and unable to defend myself in a court of law, and done everything to keep me from being paid. They have also invariably aided one pirate after another, some from England, France, and America, to come forward to use my inventions for telegraphing by colours, under other names, in order to evade paying me for an invention and code of signals so useful and complete that they have become now universal throughout the whole world, both by steam and sailing vessels on the ocean and on all railways by land; and because I would not submit to the insolence of office, and be bullied by a naval captain, and give a share of the money I was entitled to receive for them. Ever since 1846 I have been kept out of my just claims by my Lord John Russell's Lords of Admiralty! These signal and telegraphs were brought out on the banks of the Clyde by the late Earl of Haddington and Sir R. Peel's Government in 1843. The trials at Portsmouth will be found in the *Times* and press of the day, and in documents laid before the House of Commons. But when the Whigs came into power in 1846 they not only set their own creatures to carry out my plans and inventions, to the ruin of myself and family, though they know I was promised by Sir R. Peel's Government pay and place to carry them out. Trusting you will insert and counteract any such false statement as to my being paid, which I have reason to expect from your well-known wish to protect inventors. I am, Sir, yours obediently,

R. RETTIE, C.E.

The inventor of all the coloured signal telegraphs by sea or land for night and day now in use throughout the world.

The following suggests useful considerations, if it does no more:—

GENTLEMEN,—Although I highly appreciate the movement for promoting the object of educated female labour, I very much fear that in practice the good effected will fall far short of the present expectations of the benevolent promoters, and even of yourselves. There is at present a great amount of labour for females, but the competition and covetousness of manufacturers turns into a curse that which might be a blessing. Almost every department of present female labour was once well paid for, and those employed worked a reasonable number of hours, obtained good wages, and appeared, and were respectable. But their want of moral courage is taken advantage of by their rapacious employers, and their wages are curtailed until hard work is little better than starvation. Poor girls now work at india-rubber goods for a penny an hour! These low wages generally lower the morals, and bring other evils in their train. In the town of Locle, in Switzerland, females who work at the finest parts of watches earn five francs a-day. An equal remuneration in London would be about 10s. a-day. Now, what English manufacturer would think of paying a female 10s. a day, whatever the work? Instead of this I believe they will be ground down to a condition little better than the shirt-makers, their Swiss sisters will be injured, and then the cuckoo note will be repeated, "We want employment for females." T. MOY.

1 Cliffords Inn, Nov. 29, 1859.

The standards which the Treasury were required to provide by the third section of Lord Redesdale's "Act for regulating measures used in sales of gas," have been duly deposited, says the *Journal of Gas Lighting*, in the office of the Comptroller of the Exchequer, No. 6 Old Palace Yard, Westminster. "They comprise a weight of 62·321 lbs. avoirdupois; a bottle containing that weight of distilled water at a temperature of 62° Fahr., and a barometric pressure of 30 inches; and a king's cubic foot transferrer. The whole have been prepared under the direction of and verified by the Astronomer Royal, assisted by Professor W. Miller, of Cambridge. The weight is of brass, and has been made by Mr. L. Oertling, the well-known balance-maker of Store-street, Bedford square. The cubic foot bottle is a copper cylinder with conical ends terminating in tubes, the bottom one being closed by a cock, and the upper one being open. It has been manufactured by Messrs Ladd and Co., of the Old Jury, the hydrometer makers to the Excise; and the cubic foot transferrer has been made by Messrs. Crossley and Co., of the Southwark Bridge Road. It does not appear to be considered necessary at present to prepare any standard multiples or decimals of the cubic foot measure, but gas companies and others can have the indices of their own testing gasholders adjusted to the Exchequer standard, or they can procure duplicates of the cubic foot transferrer and adjust the indices themselves. They may, by adopting either of these courses, ascertain at once what metres do and what do not comply with the tests prescribed by the Act, and thus mitigate to some extent the inconveniences to which the further delay in the appointment of inspectors under the Act is now subjecting them."

A correspondent desires to offer the following suggestion and observations:—

Clifton Cottage, Montague-road, Uxbridge, November 24, 1859.

GENTLEMEN,—The observations of two correspondents in your last number upon ships' chain cables have suggested to me the desirability for some elastic medium between the straining points of the cable. Of its practicability I do not pretend to judge—whether it would be feasible to pass the cable over or round a suspended pulley of proper dimensions. The bottom pulley being of solid iron, and sufficient weight to overcome the average strain, yielding only to a sudden or heavy one, that would be dangerous to the integrity of the cable. Perhaps the mention of the subject might bring forward a practical plan. I have also seen a paragraph in last week's *Builder*, describing an improved propeller upon the principle of a duck's motion in the water, which corresponds exactly with one I have been endeavouring to mature so as to allow of several fans working at the same time, which would be necessary to obtain an even motion for the vessel; these might be arranged either along the keel, at the bows, or the stern, vertically or horizontally, and would doubtless with proper fans obtain a good hold of, and exert great power in, the water.

I am, Gentlemen, your very obedient servant,

W. A. BENDELOW.

The screw steamer City of Baltimore, on her last voyage from New York, encountered the full force of the late storm without any material injury.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 1047.

BOILERS AND THEIR FURNACES, &c., 1042, 1049.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 1018, 1034, 1046.

SHIPS AND BOATS, including their fittings, 1020, 1023, 1037.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 1027, 1041.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals. *None.*

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1008, 1024, 1028, 1031, 1032, 1038, 1050.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., *None.*

LIGHTING, HEATING, AND VENTILATING, 1009, 1021, 1052.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1007, 1013, 1014, 1015, 1019, 1035, 1043.

METALS, including apparatus for their manufacture *None.*

CHEMISTRY AND PHOTOGRAPHY, 1045.

ELECTRICAL APPARATUS. *None.*

WARFARE. *None.*

LETTER PRESS PRINTING, &c, *None.*

MISCELLANEOUS, 1010, 1011, 1012, 1016, 1017, 1019, 1020, 1022, 1025, 1026, 1029, 1030, 1033, 1036, 1039, 1040, 1048.

1007. E. LEWTHWAITE and G. AMBLER. "Improvements in clocks, watches, chronometers, and other timekeepers." Dated April 21, 1859.

This relates, 1, to the escapement, and consists in dispensing with the pallet-wheel now used, and substituting in lieu thereof a piece which is called a propeller, which may be either of metal or stone, formed with one or more very short arms, pins, or radii, which act upon the pallet as a dead beat or otherwise. By this improvement the patentees avoid to a great extent the variation in time caused by the change of temperature expanding and contracting the pallet-wheel. It relates, 2, to the fusee, and consists in having the driver or first motion wheel formed with inverted cogs or teeth in addition to the cogs or teeth now thereon, such said wheel to be loose upon the axis or spindle of the fusee, and gearing with a small pinion working on a stud attached to the fusee, which gears with another pinion fixed on the axis or spindle of the fusee. By the above means power or continuous action is maintained whilst winding up the timekeeper. *Patent completed.*

1008. E. CLARK. "Improvements in sewing machinery." (A communication.) Dated April 21, 1859.

This consists, 1, in a method of securing two or more needles in the needle carrier. 2. In sewing compound seams by the use in combination with two or more needles, of one or more tongues of metal attached to the bed of the machine, and one for each space between every two needles. Also in combining with the said tongue or tongues a concave bed piece, the object of the bed piece being to give support to the cloth on both sides. 3. In uniting compound seams, by combining with two or more eye pointed needles a vibrating thread carrier. 4. In guiding the cloth to the needle in forming seams when one or both pieces of cloth is or are lapped or folded over to make a flat seam by the use of two guide plates suitably arranged. 5. In guiding the cloth to the needle in sewing hems by attaching the tube guide for holding the hem to the bar of the presser foot by a yielding arm having sufficient space between the upper surface of the presser and the hem guide for the passage of the cloth. 6. In operating the instrument which feeds in the cloth by a single lever. *Patent completed.*

1009. G. ROBERTS and J. BRIDGES. "Improvements in the manufacture of candles." Dated April 21, 1859.

Here the wick is first dipped into the hollow to obtain a certain substance, and after getting cool is then dipped into a composition of tallow, resin, and pitch, or resin and tallow, or pitch and tallow, in the proportion of about eight parts of tallow to two or more parts of the other material. When cool, it is again dipped into the tallow, and giving layer for layer as required, until the size is obtained, invariably keeping a layer of tallow on the outside surface. These can-

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dles can be burnt with plaited or common wicks. *Patent completed.*

1010. T. S. TRUSS. "Improvements in the construction of pipes, and in the mode of joining the same." Dated April 21, 1859.

The patentee claims the making of an expansive or contractile joint by which pipes for the transmission of gas, water, steam, or other fluid are to be secured together by means of a compressing or nut-coupling strap, in two or more parts, with packing material upon, between, or around the ends of the pipes embraced by the strap. Also, the making of the junctions of coupling straps with recesses and corresponding projections or loose blocks. Also, the making of pipes with flanges at or adjoining their ends to be used with, or operated upon by a compressing or nut-coupling strap with packing material upon, between, or around the same, and embraced by the strap. *Patent completed.*

1011. J. H. PEPPER. Improvements in apparatus for showing stereoscopic pictures." Dated April 21, 1859.

This consists in so combining apparatus that the two stereoscopic pictures shall be thrown side by side on to a screen or surface by lanterns having suitable lenses, so that when seen by several persons through different lenses (having focal powers according to their several distances from the screen or surface) each person shall see the two projected pictures as one largely magnified stereoscopic picture. *Patent abandoned.*

1012. H. KEACH and G. H. FARRINGTON. "Improved advertising circulars." Dated April 23, 1859.

Here, a sheet of card, paper, or other material, being folded in one or more folds, covering each other, or in the manner of a tailor's pattern book, the inventors draw or print on each side of the various folds subjects or pictures, which may be embossed or not. They then cut out or perforate by dies, stamps, or otherwise pieces of the folds in different shapes and sizes, which admitting some portion of the underfold to sight, produces a scenic effect, developing a different scene or picture as each flap is unfolded. *Patent abandoned.*

1013. R. GRAY. "Improvements in crinoline skirts." (A communication.) Dated April 23, 1859.

The inventor proposes to attach the hoops to the cords or tapes by metallic clasps or fastenings. *Patent abandoned.*

1014. C. MANSEL. "A folding travelling case." Dated April 23, 1859.

This consists of a strip or longitudinal wrapper of oilskin, leather, &c., provided with a transverse arrangement of pockets or envelopes, of forms suitable for the reception of articles, together with bands of elastic material secured to the wrapper so as to retain the smaller articles in their places upon the folding of the case, to which also an extensible action is given for rendering the case adjustable to the contents or variable capacity of the same, straps or buckles being used for securing the case when folded. *Patent completed.*

1015. J. EDWARDS. "Improvements in the manufacture of buttons." Dated April 23, 1859.

This relates to an improved method of forming the holes in "sewn through" buttons. A hollow well is formed in the centre of the button leaving a projection or other stop round the button on the inside; into this hollow well a bar of iron is inserted and forced down to the bottom, thereby forming the holes by which the button is sewn on to the garment. *Patent abandoned.*

1016. J. ARMSTRONG. "Improvements in drying and preserving timber." Dated April 23, 1859.

The timber to be dried and preserved is placed in a suitable chamber, and is subjected to the direct and immediate action of steam, which both dries the timber and opens its pores for the reception of the creosote or other preservative. *Patent abandoned.*

1017. J. GILLIES. "Improvements in branding or marking wood for casks, barrels, and other purposes." Dated April 23, 1859.

The apparatus here used consists of an open cast iron frame, on the platform or table of which is placed an open-topped elliptical case of cast iron, perforated all round for the admission of air, and for the escape of the products of combustion. Within this case there are one or more vertical gas burners, adjustable as to height. Each burner consists of an inner cylindrical shell closed at the top, and perforated all round the lower part for the escape of the gas. This inner cylinder is surrounded by an outer and larger cylinder, also perforated, the flame rising up between the two cylinders. The flame plays directly upon the lower plain surface of the branding die plate of metal, the upper working face of which is cut or cast with the necessary names or devices in relief. The platform framing also carries a bracket pillar piece, the overhanging eye of which has a large nut in it for the reception of a vertical screw spindle terminating at its lower end in a horizontal pressure plate. The top of the screw spindle has a horizontal wheel or weighted arm upon it, so that the arrangement resembles that adopted in fly or punching presses. Each piece of wood to be branded is laid flat down upon the operating face of the branding die-plate on the open top of the gas-burner box, and the attendant then screws down the pressure plate by turning the wheel or actuating over-head arm. In this way the wood is pressed hard down upon the heated branding plate, the pressure being kept up for a longer or shorter time. *Patent completed.*

1018. J. ANGUS. "Improvements in saddles." Dated April 23, 1859.

This relates more particularly to those saddles employed for carting purposes. In cart saddles the trough of the saddle-tree is composed of four pieces of metal, the bottom of the trough being made up of two pieces of wrought iron, forming a but point at the centre or crown of the arch. These two bottom pieces of metal are riveted to the convex side of an under piece of wood correspondingly curved, and they are so rolled or shaped as to be thinned off at the contiguous junction ends whilst they increase in thickness to the usual external end plate pieces for the play of the chain or back band. The sides of the trough are formed of two parallel flanged or vertical edge pieces which are riveted through the main wood bottom by transverse rivets from side to side. The upper edges of these two side or flange pieces are turned over with a moulding or head cover, and the forward flange is thickened at each end on the inner side to resist the forward frictional pressure of the chain or back band on going down hill or backing. There are modifications included. *Patent completed.*

1019. W. DICKS and W. HOPWELL. "Improvements in machinery for making screws and applying them in fixing the soles of boots and shoes." Dated April 23, 1859.

Here the wire or metal rod is fed into the machine through a tube which receives rotating motion from the main or shaft of the machine by the aid of a suitable train of wheels interposed between the main or driving shaft and the tube, provision being made for changing the speed of the tube, and consequently the length of screw produced by means of change-wheels. The main or driving shaft is put in motion by a treadle, or by hand, or by other power. The wire as it leaves the tube passes between two rollers placed at the front of the tube, and such rollers hold the wire securely. The forward end of the wire is at all times between a pair of screw dies or cutters fixed or held in front of rollers, so that as the wire is caused to rotate a screw will be cut thereon, and the end will be caused to protrude more and more through and beyond the dies or cutters. In order that the act of making or cutting a screw or the wire may be the cause of its entering into the sole of a boot or shoe, there is a proper table or platform used, on the boot or shoe is held up to the die or cutter in such manner that the screw as it protrudes beyond the dies or cutters is caused to enter into the sole. When the proper length of screw has been cut, and has entered the sole, it is cut off by a suitable cutter, which cuts the screw flush with the outer surface of the sole. In order that the motion of the tube and rollers may be stayed whilst the cut is being effected, and the sole moved a distance equal to that between the neighbouring screws in the sole, provision is made to stop the formation of the screw for a time by means of a cam and interposed mechanism whilst the cut is being made, and so soon as the cut has been made and the sole is again in a proper position to receive another screw, the gearing communicating to the tube and apparatus holding the wire, are brought into action till the proper length of screw has been again made and screwed into the sole, and another cut by the cutting apparatus is required to be performed. *Patent completed.*

1020. P. L. M. DEBAIN. "Improved means for transmitting motive power to ships' pumps, and other arrangements by which the displacement of fluids is effectuated." Dated April 23, 1859.

This consists in providing a vessel in the form of a hollow sphere, in the interior of which is situated a diaphragm formed of any suitable elastic material, which diaphragm receives on one of its surfaces the impetus of steam, vapour, or other motive power, and by its opposite surface transmits this impetus to the water or other liquid to be acted upon, and which latter at the required moment, and by means of proper valves, cocks, &c., is permitted to come in a proper situation for being acted upon by one of the surfaces of the diaphragm, whereas the action of the steam or other prime motor on the opposite surface of the diaphragm is also regulated by any suitable means. *Patent abandoned.*

1021. P. F. MUTEL and L. H. BLANCHARD. "Improvements in gas burners." Dated April 23, 1859.

The inventors introduce and fix on argand burners a plate, and in this plate at the required distances apart small tubes of iron, or any other suitable metal or material, and of the required diameter and length, according to the size of the burner, through which tubes the gas issues from the burner. *Patent abandoned.*

1022. P. L. M. DEBAIN. "Improvements in making heat subservient for producing motive power." Dated April 23, 1859.

This consists in arrangements by which the heat obtained by causing compressed air to be injected, and burned on a burner, or fire-place situate in the interior of a suitable vessel, serves for evolving steam or other elastic vapour from water, or other suitable liquid or solution contained in a boiler in which this burned air is allowed to enter, by which arrangement consequently the evolution of steam or vapour, and the concentration of the solution or liquid, are obtained simultaneously, while the steam or vapour is further caused to act on the elastic diaphragm, with which is provided a motive power transmitting vessel. *Patent abandoned.*

1023. W. GIBSON. "Improvements in steering apparatus." Dated April 23, 1859.

This invention was described and illustrated at page 24, No. 28, vol. 2, of the MECHANICS' MAGAZINE (New Series). *Patent completed.*

1024. R. A. BROOMAN. "An improvement in the manufacture of woollen cloth." (A communication.) Dated April 23, 1859.

This consists in incorporating woollen waste, or the shearings produced in the shearing mill, with cloth, after the same has been woven, and during the fulling thereof. The fulling bath may be composed of a mixture of soap and water, and of woollen shearings, and while being filled the cloth becomes furnished with the woollen particles. *Patent completed.*

1025. J. MARSHALL, jun. "Improvements in filtering and depurating fluids." Dated April 23, 1859.

This invention is not described in detail apart from the drawings. *Patent completed.*

1026. W. MOXON, and J. J. BENNETT. "Improved apparatus for raising or lifting and lowering heavy bodies." Dated April 23, 1859.

This consists in so arranging the apparatus employed for effecting the above operations, that two or more weights may be simultaneously lifted by the same motive agent. The invention is not fully described apart from the drawings. *Patent completed.*

1027. F. C. MAGUIRE. "Certain improvements in the utilization of sewage manure." Dated April 23, 1859.

This consists in raising by steam or other power sewage to reservoirs of sufficient height and space for the operations of machinery, to allow such sewage to traverse the various lines of railway or roading in, through, or along stone, earthenware, or such other pipes or channels as may be most convenient and economical for the purposes required, with inclosed receptacles at the various railway stations throughout the three kingdoms or depôts on the various roadways to allow of it being carried away from such stations or depôts in manure distributers, or taken in pipes to any farm, homestead, hamlet, village, or town laid within the three kingdoms for the purposes of irrigation and fructification. *Patent abandoned.*

1028. W. STEVENSON. "Improvements in spinning, doubling, and manufacturing cotton, and other fibrous materials." Dated April 25, 1859.

This consists in so arranging throstle spinning frames that the present indirect drag upon the bobbin may be done away with, the winding-on action being effected by a special movement for the purpose. *Patent completed.*

1029. W. P. BALFERN and M. MCKAY. "The manufacture of sweet-figged soft soap." Dated April 25, 1859.

For the manufacture of this kind of soap the inventors first prepare caustic leys by mixing 100 parts of American potash with 80 parts of lime and a sufficiency of water, and boiling the same until it becomes completely caustic. They then pour into the soap from 200 parts of the prepared leys, at 18° Beame, and bring it to the boiling point, when they add 14 parts of tallow. This being dissolved and the liquor boiled for 15 minutes, they add 14 parts of olcine obtained from palm oil, in the manufacture of candles or otherwise. After a further boiling of 15 minutes they add 28 parts more of oleine, and so continue to add and boil until 100 parts of oleine have been incorporated and saponified. *Patent abandoned.*

1030. J. HIGGIN. "Improvements in treating

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madder and plants of the same family, and preparations therefrom." Dated April 25, 1859.

The patentee claims, 1, the subjecting madder or a preparation of it to a prolonged contact with acid at the ordinary temperature of the air previous to washing. 2. The drying a mixture of madder, or a preparation of it and acid, subsequently washing out the acid. 3. The use of corrosive metallic salts, as described in detail in the specification. 4. The manufacture of an extract of madder from the rubian contained therein in the manner described in the specification in detail. *Patent completed.*

1031. G. WARD. "Improvements in machinery or apparatus for making healds." Dated April 25, 1859.

This relates to certain improvements in Berrie and Anderson's machinery for making healds or heddles used in weaving, and consists of an improved taking-up motion worked by toothed gearing, instead of worms and worm wheels; of an arrangement of guide and stretching pulleys for enabling the entire length of the heald to be formed without winding or tapping any part on a drum; of the employment of a carrier wheel for giving motion to the pinions which turn the bobbins containing the braid bands or tie threads and also the revolving lappers; a mode of working the pusher for pushing off the eyes of the heald as they are formed, and of an arrangement for working the sliding bolts or frame for working the braiding needles. *Patent completed.*

1032. J. OWEN and H. DUCKWORTH. "Improvements in machinery or apparatus for leasing yarns." Dated April 25, 1859.

For sizeing warps the inventors place in a position beyond the rest-beam or bar of any suitable shape, with indentations cut in it of different dents or counts according to the counts or qualities of yarn to be operated upon, and at each side of the said bar they place a comb with incisions of about ⅛ of an inch in depth, so that at the time of casing one of the said combs will ascend and the other descend, thus causing one-half of the yarn threads to rise and the other to fall, by which the lease is made. They also use a brush to straighten the threads when necessary in taking the lease. *Patent abandoned.*

1033. T. A. WESTON. "A new or improved pulley." Dated April 25, 1859.

Here an endless chain is so applied to an axle of two different diameters in the two parts to which the chain is applied, or to two pulleys of different diameters, that two depending loops are formed by the said endless chain, each of the said loops hanging from one side of one part of the axle or from one pulley. When pulleys are used they are made to rotate together by being fixed together, or fixed to the same axis, the axis in this case rotating with the pulleys. *Patent completed.*

1034. T. BUCKHAM. "An improvement in railway switches." Dated April 25, 1859.

This consists in connecting the moveable switch rail to the fixed rail by a hinge-joint "fished" to each side of the ends of the switch rail and head rail. One of the hinge-joints acts as the centre on which the switch rail moves, whilst the other has the hole in which the pin fits, made oval, or slotted about one-eighth of an inch in the direction in which the rail moves, to allow of the required movement of the switch rail. *Patent abandoned.*

1035. J. HOLMES. "Improvements in applying eyelet holes to boots and shoes, and in binding boots and shoes." Dated April 25, 1859.

Here metal eyelet holes are employed in fastening the material used for binding boots and shoes at those parts where laces are used, so that the same eyelet holes serve to attach the binding and also for the passage of the laces. *Patent completed.*

1036. A. W. GADESDEN. "Improvements in producing solutions of sugar." Dated April 25, 1859.

The patentee employs a vessel having a hemispherical bottom to which heat may be applied either by an internal coil of steam pipes, by a steam jacket, or other means; across the lower part of this vessel is a perforated false bottom or partition on which the sugar is placed. Connected with this vessel is a cylinder of which the lower end descends below and the upper end rises above the perforated partition or false bottom. In the cylinder a screw or suitable propeller is applied, by which the water or liquor is constantly raised from the under to the upper side of the partition or false bottom, and is thrown on to the sugar to be dissolved. *Patent completed.*

1037. E. HUMPHRYS. "Improvements in steering apparatus." Dated April 25, 1859.

Here a cylinder is used in which a piston is moved to and fro by the pressure of water. The rod of this piston is connected to an arm on the rudder-post. *Patent completed.*

1038. W. E. NEWTON. "Improvements in sewing machines." (A communication.) Dated April 25, 1859.

This invention is not described in detail apart from the drawings. *Patent completed.*

1039. H. C. HUBBY. "Improved means of and apparatus for obtaining motive power." Dated April 25, 1859.

The chief object here is to obtain an effective motive power by the combined forces of attraction and repulsion between a large number of magnets, whether electro or other, with constant poles and other electro-magnets whose poles are varied, such large number of small electro-magnets being made to act with considerable rapidity instead of a small number of large magnets acting more slowly. *Patent completed.*

1040. W. WARNE, J. A. FANSHAWE, J. A. JAQUES, and T. GALPIN. "Improved compounds applicable for packing the joints of steam or other pipes, which compounds are also applicable for packing or lining parts of machinery in general, or parts of ships, bridges, tanks, or railways." Dated April 25, 1859.

In manufacturing their compounds the patentees employ caoutchouc, gutta-percha, bituminous, resinous, or gelatinous substances, metal filings, pulverised ores of metals, or oxide of iron or manganese. Salamoniac and other suitable chemical agents may be added. *Patent completed.*

1041. S. L. TAYLOR. "Improvements in agricultural implements, in obtaining motive power for actuating such implements, and in apparatus connected with the application of steam power." Dated April 25, 1859.

This consists, 1, in arranging single or double-breasted ploughs on a shaft or axis with the one of a pair or half the number of a series arranged above the axis, and so that the one will plough in the one direction, and the other in the opposite direction. 2. In placing the jointed parers which are attached to the sole of the plough on bolts or joints, on which they can move, so as to be set wider or narrower. 3. In arranging scarifiers, rakes, &c., on an axis which has a locking plate and a spring catch applied, which when let go allows the instrument to rotate on the axis, and thus releases any matter that may clog their working. 4. It relates to implements dragged by horses, and consists in mounting and fitting the drag frame in the forewheels and carriages, so that it has an oscillating motion in two directions, the one at right angles to the other. The invention also relates to engines for actuating agricultural implements, and comprises a variety of detail which we cannot particularise. *Patent abandoned.*

1042. T. HOLT and J. BROWN. "Improvements in apparatus or an improved apparatus for heating water for the supply of steam-boilers, which improvements or apparatus are also applicable in some cases for the prevention of incrustation in steam-boilers." Dated April 26, 1859.

This consists in a mode of rendering available for the heretofore wasted heat, that is to say, in the use, adaptation, and application of a vessel, tank, or cistern placed in juxtaposition with that end of the boiler which is remote from the furnace, in such a position as to be impinged upon by the flame vapour and heated products of combustion proceeding from the furnace, and issuing from the said end of the boiler through the mouth or opening of the first flue (or flues), and the said tank serving as a reservoir through which the feed water before entering the boiler is made to pass, and to have its temperature raised by the heat derived from the vapour or flame intercepted by the said tank, or passing in contact therewith. *Patent completed.*

1043. H. ALLMAN. "Certain improvements in the construction of window-blind mountings, and in apparatus connected therewith." Dated April 26, 1859.

This invention is not described apart from the drawings. *Patent completed.*

1044. W. MACKENZIE. "An improved method of printing impressions upon an enlarged scale, either from engraved plates, electrotypes, blocks, drawings, or other surfaces." Dated April 26, 1859.

The patentee claims the making of electrotypes, &c., upon an enlarged or reduced scale for printing or other purposes when such electrotypes shall have been made by the use of any elastic material transferred and prepared as described to give the necessary depth and arrangement of parts to produce the electrotype plate, block, die, or other printing surface. Also the making of moulds and stereotype plates in place of electrotype when such have been increased or diminished by the elastic properties of vulcanised india-rubber or other elastic substance. *Patent completed.*

1045. W. E. NEWTON. "Improvements in the manufacture of nitric acid and its application for the production of artificial nitrous or nitric salts." (A communication.) Dated April 26, 1859.

This relates, 1, to the production of nitric acid or its salt by the decomposition of atmospheric air by means of dynamic and static electricity. 2. The subsequent absorption of the nitric acid thereby produced by water so as to form commercial nitric acid, or by its combination with suitable alkaline bases to form nitrous or nitric salts. *Patent completed.*

1046. R. MAIN. "Improvements in wheels for carriages." Dated April 26, 1859.

According to this invention there is a hollow space formed in the felloe of the wheel, in which is inserted a series of segmental links connected together by pins, and forming together a kind of chain all round the wheel. The inner side of this chain rests against springs fixed in the inner part of the felloe, and the outer part of the chain is thus made to project beyond the tyre and form a projecting ring or flange on the circumference of the wheel, so as to be capable of holding and guiding the wheel on a tram or rail. By this construction of the wheel, also, the weight of the carriage will be caused to press the flange inwards against the springs; so as to admit of the wheels running on ordinary ground. It also consists in the construction of wheels intended to run on ordinary ground with elastic projections on their circumference. For this purpose a hollow space is formed in the felloe of the wheel in which springs are inserted, and projecting pieces are inserted through spaces in the tyre at intervals so as to rest against the springs. Thus the projections around its circumference will yield to the unequal pressure of the ground. *Patent completed.*

1047. W. MARSHALL. "Improvements in steam engines." Dated April 26, 1859.

This refers to a previous patent dated 19th Nov., 1858, and consists in placing the high pressure, or smaller cylinder, inside the low pressure or larger cylinder. These engines, as adapted for a screw steamer, consist in each case of a pair of large inverted low pressure steam cylinders supported upon suitable framing upon a bottom sole plate. *Patent abandoned.*

1048. R. A. BROOMAN. "Improvements in vulcanising and colouring caoutchouc, and in the preparation of caoutchouc paints, and colours." (A communication.) Dated April 26, 1859.

This consists, 1, in vulcanising caoutchouc by passing it successively through baths formed, first, of benzine, cromate of sulphur, and red or black sulphuret of mercury, and, next, of chloride of lime and water. 2. In preparing a colouring for caoutchouc by first dissolving a portion of caoutchouc in benzine, turpentine, olive oil, or other solvent, and in adding thereto suitable colouring matter, in certain proportions, according to the colour required to be provided. *Patent completed.*

1049. R. A. BROOMAN. "Improvements in steam boilers." (A communication.) Dated April 26, 1859.

This consists in protecting the body of steam boilers from the direct action of fire by a protecting chamber placed behind the bottom of the boiler and the furnace, through which chamber the feed water is made to pass before entering the boiler. *Patent abandoned.*

1050. J. H. JOHNSON. "Improvements in machinery or apparatus for combing wool and other fibrous substances. (A communication.) Dated April 26, 1859.

The objects here are the keeping the fibrous substance itself, whilst undergoing the process of combing, in direct contact with a heated surface, and also the avoiding the circuitous path in which the fibrous material in all other combing machines is made to travel. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Aug. 12, 1859.

1861. L. A. Possoz. Improvements in the manufacture and baking of sugars.

Dated Oct. 15, 1859.

2359. R. Smith. The purification of water and other fluids.

Dated Oct. 25, 1859.

2435. G. Canouil. New machinery for priming percussion caps without danger of explosion, also a new fulminate not hitherto employed.

Dated Nov. 2, 1859.

2494. B. Browne. A self-heating ironing apparatus. (A communication.)

2496. R. H. Hess. Improvements in gas burners.

Dated Nov. 3, 1859.

2498. J. Leeming and J. C. Ramsden. Improvements in looms for weaving.

2502. W. Wilson. Improvements in machinery for the manufacture of felted fabrics, suitable for the bodies of hats, caps, and bonnets.

2504. J. Howard. Improved machinery for

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moulding hollow bricks and tubular articles. (A communication.)

Dated Nov. 4, 1859.

2506. A. Binckes. Improvements in optical instruments.

2508. G. N. Buller. An improved mode or method of ornamenting articles composed wholly or partially of jet.

2510. J. A. Maxwell. Improvements in hydraulic engines to act either alone or in combination with steam and steam engines.

2512. F. H. Holmes. Improvements in apparatus for transmitting light.

2514. A. V. Newton. Improvements in type-setting and distributing apparatus. (A communication.)

2516. W. Hill. Improvements in lightning conductors.

2518. J. Chesterman. New and improved methods of and furnace for heating, hardening, and tempering clock springs, watch springs, band saws, steel for dresses, such as crinoline steel, and other like purposes.

Dated Nov. 5, 1859.

2520. C. Mackenzie. Improvements in machinery or apparatus for cutting and dressing staves for casks, barrels, and other wooden vessels.

2522. F. Pichler and H. J. Wigley. The arrangement and construction of wheeled carriages or other vehicles or machines, in such manner that the occupant or occupants thereof may propel the same by alternating the weight of the person or persons riding.

2524. G. T. Bousfield. Improvements in machinery for grinding and polishing sheets of plate and other glass. (A communication.)

2526. W. Maunix. Improvements in the manufacture of manure.

Dated Nov. 7, 1859.

2528. A. L. Dowie. Improvements in effecting communications or signalling between distant or distinct parts of railway trains.

2530. G. Pacey. A rein handle and holder applicable for riding or driving, either for single, double, or team reins.

2532. H. Barker. An improvement in clay, meerschaum, and other pipes.

2536. A. Templeton and J. Lawson. Improvements in the manufacture of chenille or like fabrics suitable to be used in woven and other ornamental piled fabrics.

Dated Nov. 8, 1859.

2540. J. Thomson. Improvements in the manufacture or production of Brussels and velvet pile carpet fabrics and hearth rugs.

2542. J. H. Johnson. Improvements in watches or time keepers. (A communication.)

2544. T. S. Bottom. Improvements in the manufacture of chenille.

Dated Nov. 9, 1859.

2546. J. Hamer. An improved material for insulating the wires of electric telegraphs, for lining articles of dress, for covering, clothing, casing, or lining steam boilers, pipes, cylinders, and other vessels, conduits, or chambers, and for other similar purposes, to which the said material is or may be applicable as a non-conductor, for preventing or diminishing the transmission of heat or of the electric fluid.

2548. D. Fulton. Improvements in cylinders or rollers for printing and other purposes.

2550. G. Spill and D. Spill. An improvement in the manufacture of bands for driving machinery, and for various other purposes.

2552. W. Clark. Improvements in the construction and application of electric telegraph wires or conductors. (A communication.)

Dated Nov. 10, 1859.

2554. J. Edwards and J. S. Wright. Improvements in the manufacture of buttons.

2556. J. Tenwick. Improvements in the construction of street gutters.

2560. W. Fletcher. Improvements in machinery for making looped fabrics.

Dated Nov. 11, 1859.

2562. F. D. Jones. A weaver's loom with combs opened at the summit, and with moveable floating chains. (A communication.)

2563. T. Blinkhorn. Improvements in pumps.

2564. R. A. Brooman. The preparation of a salt, and means of combining, mixing, or applying the same to render fabrics, pulp, wood, oil, and other substances uninflammable. (A communication.)

2565. R. A. Brooman. An improved method of preparing plates and cylinders for printing from. (A communication.)

2566. A. Jacquelain. Improvements in the manufacture of carbon and in apparatus employed therein.

Dated Nov. 12, 1859.

2567. R. Lansdale. Improvements in machinery or apparatus for washing and cleansing fabrics, which improvements are also applicable to churning.

2568. W. Burgess. An improvement in mowing and reaping machines.

2569. J. Scott. An improvement in anchors.

2570. A. Vickers. A method of opening and shutting two or four gates or doors simultaneously, and for fastening the same when either open or shut, applicable to railway crossings and other purposes.

2571. C. Norrington. Improvements in the protection of ships or vessels, forts, or batteries, from cannon shot, shell, or any other projectile.

2573. E. A. Burgess-Burgess. Improvements in the preparation of anchovies.

Dated Nov. 14, 1859.

2575. P. Graham. Improvements in machinery or apparatus for cutting wood.

2576. A. Applegath. Improvements in surface block printing.

2577. J. Madin. Improvements in furnaces and appliances connected therewith, for hardening and tempering crinoline or sheet steel, and measuring the same.

2578. J. Walworth and R. Harrowby. Improvements in smut machines or corn screens.

2579. J. and G. Goldberg. Certain improvements in the construction of purses or "porte-monnaies," and in an improved lock or fastening applicable to purses, bags, or other similar receptacles.

2580. A. R. Arrott. Improvements in the manufacture of carbonate of soda.

2581. C. H. Brooks. Improvements in apparatuses for paying out and hauling in telegraph cables.

2582. J. Holgate and J. Henderson. Improvements in locomotive engines, partly applicable to other steam-engines.

Dated Nov. 15, 1859.

2585. W. H. Ward. An improved turn-table for railways and other purposes.

2586. E. Borase. Improved apparatus for separating metals and metallic ores, when mingled with other substances in the state of slime.

2587. J. Donald and P. Smith. Improvements in apparatus for raising and for extracting liquids.

2588. C. Chalmers. Improvements in gas stoves, for heating buildings, apartments, and other similar places.

2589. W. Elliott. An improved method of raising water and other liquids.

2590. C. P. Alvey. Improved machinery or appatus for the manufacture of envelopes.

2591. W. H. Ward. Improvements in tanning hides and skins.

2592. W. Wilkins. "A ridge trestle," or apparatus which may be employed on the ridges of buildings to support persons and planking.

2593. A. V. Newton. An improvement in the manufacture of hose or flexible pipe. (A communication.)

2594. T. D. Perkin. Improvements in the manufacture of colouring matters. (A communication.)

2595. J. Graham. Improvements in treating and applying products obtained when galvanizing iron.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

2314. J. Willcock. Improvements in the construction and arrangement of the boiler and working parts of steam fire-engines, parts of which are applicable to engines for other purposes. (A communication.) Dated Nov. 19, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(From the London Gazette, Nov. 29, 1859.)

1695. W. E. Newton. Batteries. (A communication.)

1711. J. Todd, jun. Dressing seeds.

1714. C. and J. B. Tapp. Boilers and furnaces.

1775. J. Mollady. Hat.

1809. E. J. Cordner. Saving life from shipwreck.

1857. J. T. Pitman. Lubricating. (A communication.)

1858. W. Bouch. Breaks, buffers, and couplings.

1894. A. V. Newton. Carriages. (A communication.)

1935. D. and J. Russell. Docking ships.

1999. J. Bernard. Boots and shoes.

2062. W. C. Gelge. Nails. (A communication.)

2132. A. Lamb. Heating feed water.

2245. R. Brearley, jun. Raising the nap of cloths.

2334. W. Prosser. Production of light.

2358. N. Montanari. Aiding children in walking.

2369. J. Bernard. Boots and shoes.

2405. J. T. Pitman. Malleable iron. (A communication.)

2424. A. L. Dowie. Gas burners.

2450. J. Armour. Measuring and regulating supplies.

2487. L. Pohl. Fastenings.

2498. J. Leeming and J. C. Ramsden. Looms.

2528. A. L. Dowie. Signalling between parts of trains.

2536. A. Templeton and J. Lawson. Chenille.

2540. J. Thomson. Carpet fabrics.

2550. G. and D. Spill. Bands for driving machinery, &c.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Nov. 25, 1859.

924. W. A. Martin and J. Purdie.
1237. J. Harmer.
1289. R. A. Glass.
1291. A. Prince.
1311. W. Weild.
1313. P. Aitchison and T. Binks.
1315. H. N. Nissen.
1321. R. A. Brooman.
1324. M. Davis.
1329. W. Gossage.
1366. H. N. Penrice.
1421. G. C. Ash.
1425. A. Smith.
1430. G. Smith.
1491. L. D. Owen.
1555. R. Kay, J. Marock, J. Whittaker, & T. Booth.
2059. J. G. N. Alleyne.
2073. M. A. F. Mennons.
2157. J. Dales.
2201. D. Stewart.
2221. J. H. Johnson.

Sealed Nov. 29, 1859.

1325. A. Smith.
1326. W. Grimshaw.
1330. J. Fry.
1333. I. and R. Blackburn.
1335. A. Mickelthwate, J. Peace, and S. J. Hobson.
1336. E. Leeson.
1339. W. Smith.
1340. J. S. Cockings.
1341. S. Carr and G. Butterworth.
1343. J. Wansbrough.
1348. F. and A. Roberts.
1350. G. H. and H. R. Cottam.
1351. F. W. Saltonstall and A. Bush.
1356. S. Bary.
1357. S. Bary.
1370. A. R. Arrott.
1377. G. Davies.
1379. C. James.
1424. O. Mangs.
1446. N. C. Szerelmey.
1452. H. F. Smith.
1456. T. Cattell.
1457. T. Orrell, jun.
1539. W. E. Newton.
1559. T. Bell.
1590. J. Watkins and J. Pugh.
1778. E. Merrell.
2170. T. B. Dill.
2237. J. Macintosh.
2269. J. Macintosh.
2277. W. Macfarlane.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2767. J. Roberts, J. Dale, and J. D. Pritchard.
2782. J. Broadley.
2788. C. E. Heinke.
2789. J. Orr.
2793. H. Bongleux.
2798. A. V. Newton.
2800. J. Brown and J. Adin.
2802. F. N. Clerk.
2810. W. Woode.
2815. C. A. Tissot.
2823. L. C. Stuart.
2829. J. Brown.
2849. G. Collier and J. W. Crossley.
2867. A. and W. Bullough.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

877. T. A. Cook.
884. R. B. Feather.
900. S. C. Lister and J. Warburton.
919. J. Barlow.
1025. H. Clayton.
1073. A. Comtry.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Nov. 25, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No	Pr.	No.	Pr.	No.	Pr.
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967	10	975	3	983	3	1000	3	1011	3	1022	3
968	3	976	3	984	3	1001	3	1012	3	1023	9
969	3	977	3	985	1	1002	3	1013	3	1024	3
970	3	978	10	986	3	1003	6	1014	6	1025	10
971	8	979	3	987	7	1004	3	1015	3	1026	3
972	13	980	3	988	3	1005	10	1016	3	1027	3
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976	3	984	7	992	3	1009	3	1020	3	...	...
977	11	985	3	993	3	1010	7	1021	3	...	...

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 9, 1859.

THE TRIAL OF PATENT CASES.

How long are we to continue to adjust the rights of patentees by means of incompetent tribunals? It is notoriously true that a dozen men taken hap-hazard, even when dignified with the name of a "special jury," cannot possibly decide with satisfaction upon the difficult mechanical, chemical, and other scientific questions which are continually claiming settlement in our law courts. Why then does not the Legislature provide other means for settling the rival claims of inventors and manufacturers?

We think there are signs that a change for the better in this respect is approaching. The judges are getting disgusted with the trouble occasioned by the present arrangement, and the annoyance of one judge would lead to reform sooner than the injury of a thousand patentees. Men who have not been slow to accept the duties and the fees pertaining to the patent system, both at the bar and as Her Majesty's Law Officers, do not hesitate to denounce the present mode of trying patent causes when they get seated upon the Bench. We have a notable example of this sort of thing in the case of the present Lord Chief Justice of the Court of Queen's Bench. Sir Alexander Cockburn derived not a few emoluments from patent law cases, both as an advocate and as an Attorney-General; but Lord Chief Justice Cockburn is, notwithstanding, greatly indisposed to sit idle for days on the Queen's Bench at Westminster while "special juries" are vainly endeavouring to master the mysteries of gas apparatus, permanent ways, Jacquard machinery, compositions for protecting iron, and so forth.

We have had an example of the impatience of his Lordship during the present week, at the sitting at *Nisi Prius*. An action was brought by Messrs. Crossley, carpet manufacturers at Halifax, to recover £2,000 from Mr. Talbot, a carpet manufacturer at Kidderminster, as royalty for the use of their patents in connexion with the Jacquard loom. The royalty was secured by a deed between the parties, and the defendant, by plea, denied that in making his carpets he had used any of the plaintiffs' inventions, or any part thereof. Before the case commenced, the Lord Chief Justice said there was another patent case in the day's paper, and he really could not take up the whole time of the sittings in trying patent cases. The case was then proceeded with, but Mr. Atherton, the plaintiffs' counsel, had not concluded the opening, when his Lordship suggested that it was a matter which might be much better settled by some scientific person from an inspection of the machinery than by an inquiry in court, which would occupy two or three days. Mr. Knowles, the defendant's counsel, said he quite concurred with his Lordship. At the end of two or three days the jury would not have arrived at the knowledge necessary to commence the investigation. The Lord Chief Justice then remarked that these patent cases were nuisances. Laymen, perfectly unacquainted with the points which they were called upon to determine, were not, he said, in such an advantageous position at the end of several days as a scientific person would be in as many minutes. A juryman said he could confirm his Lordship's view. He had served upon a jury in the Court of Exchequer in a very similar case, and he believed that half of the jury were so confused by the conflicting testimony they could scarcely arrive at any conclusion. The Lord Chief Justice said it was very difficult to decide between conflicting evidence in ordinary cases, but especially so when the subject-matter was not within their cognizance. A verdict was then taken for the plaintiff, with the damages in the declaration subject to a reference. Mr. Knowles said that all parties ought to be obliged to his Lordship for making the suggestion. He was certain that this case could not have been satisfactorily tried in any other way, and few patent cases could be satisfactorily disposed of by a jury. The conversation was then concluded by the Lord Chief Justice remarking that one mind conversant with the subject is infinitely better than twelve or thirteen who are not.

These remarks, by one of our youngest and ablest judges, must not be lost sight of. The evil complained of will not be easily remedied; but a remedy must nevertheless be sought. The difficulty to be overcome is manifestly that of securing professional ability free from personal bias.

THE CORT TESTIMONIAL FUND.

WHEN statesmen and others failed to deal even justly by the family of Henry Cort, Mr. William Fairbairn, the eminent engineer, wrote last summer to the *Times*, offering the handsome sum of £100 as a first subscription to a new Cort Testimonial Fund. About the same time the facts of the case came to the knowledge of Mr. Cobden, M.P., and Mr. Bazley, M.P., and these gentlemen at once spontaneously offered to aid the movement for the relief of the family in every possible way. A committee was subsequently formed, having Mr. Fairbairn for its chairman, and Messrs. R. Cobden, T. Bazley, J. A. Turner, Ivie Mackie, J. Whitworth, B. Hick, J. Penn, and J. Boyd for its members. This committee appointed Mr. David Morris, of Market-place, Manchester, its Secretary, and several handsome subscriptions were speedily obtained. Mr. Bazley added £50 to Mr. Fairbairn's £100; and Mr. Joseph Whitworth and Messrs. B. Hick and Co. each did the same at Mr. Cort's personal solicitation. All this was done many weeks since.

Thus far we have nothing but admiration to express in reference to the proceedings of this Committee. But a week or two since we received an official circular which fills us with surprise, and, as old advocates of the Cort case, we may even say with pain. This circular runs as follows:—"At a meeting of the Committee, "held 7th November, 1859, in the Town Hall, "Manchester, the Mayor in the chair; the "Secretary reported that the sum of £210 had "been paid into the bank of Sir B. Heywood "and Co., and that £30 had been withdrawn "and paid on account to Mr. Richard Cort. "The total subscriptions to this date were "reported as amounting to the sum of £260. "Resolved—'That a circular be prepared, and "'signed by Mr. Fairbairn, as Chairman of the "'Committee, appealing to all interested in the "'subject of iron manufacture, for co-opera-"'tion and assistance to the CORT FUND, and "'that Mr. D. Morris, Secretary, issue such "'circular, accompanied by blank forms for "'subscriptions forthwith, so as to complete "'the labours of the Committee as early as "'possible.' 'That when the subscription list "'is completed, the sum raised shall be "'invested in *the purchase of annuities*, or "'some other form of securing the comfort of "'the declining years of the survivors of the "'CORT FAMILY.'"

Now, the very ground of this Committee's formation—the very basis of the *Times*' appeal, which Mr. Fairbairn followed up by his letter—the one fact which touched Mr. Cobden's tenderness in this matter—was the pressure of necessity under which the Cort family, all of whom are very aged people, are labouring. *Immediate and liberal relief* was the prime thing to be obtained. From our own intimate knowledge of the case, we can assert that at least £100 or £150 was most urgently required by Mr. Richard Cort, a man of 76 years of age, in order to meet liabilities incurred in prosecuting the case on behalf of his sisters and himself. With these facts before them, then, the Committee is formed, and £260 are, we are officially told, at once subscribed. Here, then, are the means of present and immediate relief at once secured; and the family will, of course, at once get the blessing of it. So every one would surely think; but not so think the Committee! They give Mr. Richard Cort £30—which cannot have repaid him the expenses incurred in soliciting the sums mentioned above—and put the remainder away in a bank! We do not see one word about the immediate relief of the family, even to the extent of paying what little debts they have incurred in endeavouring to secure justice for themselves; and as little do we hear about the relief of their pressing personal wants. What we do hear is, that "when the subscription list is completed"—and this may not occur for months, or even years; indeed months have already passed—*then* the sum raised "shall be invested in the purchase "of annuities," or something of that sort, for "the comfort of the declining years of the sur-"vivors." Really this is too cruel! Declining years! Why the people are all between 70 and 80 now; to talk about their declining years is almost to mock them. Declining days!—declining hours!—declining minutes, we had almost said, are all they have to look for; and to tell them that by and bye they shall have *annuities* purchased for them, and meantime to lock £230 (which have been *given to them*) up in a bank, is really to insult and wound them to the quick.

Let us not be misunderstood. We give Mr. Fairbairn ample credit for meaning and purposing well. The whole thing of which we complain is doubtless an oversight. At the same time we cannot help pointing it out and asking to have it at once corrected. Matters cannot stand as they now are a single week after this announcement without bringing odium upon the Manchester Committee.

LIFE OR DEATH IN COAL MINES.

IN 1857 the Lundhill Colliery exploded, and blew 189 men into the next world. The accident arose from the absence of efficient safety lamps, the value of which was well understood at the time. Three months ago, during an excursion to Yorkshire, we descended this same colliery, and found in it an abundance of safety lamps of the right kind. The costly steed was stolen, and *then* the door was shut! We note this fact on commencing a few remarks on this subject, because it indicates that some of the worst colliery accidents even of the present day are preventable; and this fact is a light which will greatly help to guide us aright in what we have to say.

Mr. P. H. Holland, an Inspector of Burials under the Home Office, was officially called upon to report upon the safest method of burying the numerous victims of the great explosion at Lundhill. Two months elapsed before any of the bodies could be removed, and at the end of five months some still remained in the mine. Of course the removal and burial of so large a number of putrid corpses required the most

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careful precautions, but neither skill, care, nor expense was spared; and the free ventilation secured, the use of McDougall's disinfecting powder and Dr. Stenhouse's charcoal respirator, and other precautions, were effectual in preserving all the men employed in this difficult, dangerous, and disgusting work from any serious injury. But the matter did not end here. Mr. Holland's mind became impressed with the awfulness of such accidents, and their prevention has since occupied his thoughts. The results of his inquiries and reflections have lately been given to the public in a valuable paper read at the Society of Arts.

During the last eight years there have been reported 8,015 deaths by colliery accidents, or 1,002 a year, out of about 220,000 colliers, showing a death-rate from violence exceeding four per thousand. We cannot calculate the exact proportion because we do not know the increase of the number of colliers since the census; but the death-rate by accidents among colliers is at least from six to seven times as great as the death-rate from violence among the whole population, including suicides, homicides, and the dangerous occupations. If these were excluded it is probable that colliery work would be seen to be eight or ten times as dangerous as the average. This is Mr. Holland's first great fact. In confirmation of it he states that the charge of the insurance company against death by accident is for colliers eight times the ordinary rate.

In order to show that this destruction of life is not inevitable Mr. Holland has prepared a very convincing table, which—as the accuracy of it was not questioned in a very sharp discussion that followed the reading of his paper—we may confidently assume to be correct. This table shows that in the Durham mines all the great causes of accidents—explosions, the falling in of roofs, and mishaps in shafts—and even the minor and miscellaneous causes of accidents, are guarded against with a degree of care which is altogether unknown throughout the colliery districts generally: in other words, that in the Durham mines, which are, to say the least, quite as difficult and dangerous to work as others, explosions do not occur, roofs do not fall, mishaps in shafts do not take place, and accidents generally do not happen, with anything like the same average frequency as they do in other colliery districts. In the northern districts, in which one-fourth of the coal is raised and nearly one-fifth of the total colliers employed, the deaths from explosions scarcely exceed one-twelfth, the average being only 21 out of 248 annual deaths from this cause, and these may be still further diminished by constant attention to ventilation, and especially by the use of such safety lamps as the men cannot open without extinguishing the light. It is expressly enacted in the 4th section of the Colliery Inspection Act, that "an adequate amount of "ventilation shall be constantly produced in all "collieries, to dilute and render harmless gases "to such an extent as that the working places "of the pits and levels of such collieries shall, "under ordinary circumstances, be in a fit state "for working." And by the special rules, colliers are forbidden to enter the mines until they have been examined by means of a lamp, and found safe. If the simple and common rule were universally followed, of not allowing any unprotected light in any mine, until the part of the mine worked was found safe, there could, as Mr. Holland remarks, be no explosions except in those very rare instances in which an explosive admixture of gases and air is rapidly formed. Mr. Mackworth reported that seventy-two out of seventy-three explosions, and 171 out of 172 deaths, were attributable to the use of naked lights, and that out of 1,154 deaths from explosions reported in five years, twelve only occurred where safety lamps had been used, all of which were in a defective state. Mr. Kenyon Blackwell's evidence confirms this. He says that "out of 1,099 deaths, seven only were with "safety lamps, and adds that no instance has "been properly authenticated of explosion from "a proper safety lamp; and in the most dan-"gerous mines of England, where the discharge "of firedamp is greatest, but where locked safety "lamps are exclusively used, explosions are al-"most unknown."

But, to return, if the average loss of life were reduced, as it might be, to the average of the north, instead of 1,984 killed during the last eight years, there would have been only 845. That is to say, 143 lives are annually thrown away, because the precautions proved to be effectual in Durham are not observed in Yorkshire, Lancashire, Staffordshire, Wales, &c. "Is it unreasonable," asks Mr. Holland, "to "expect that the safety of all mines shall be "raised to the standard of those of Durham, "which are naturally among the most danger-"ous? Is it too much to require that the Act "directing due ventilation shall be obeyed, and "that the possibility of having an unguarded "light in an explosive atmosphere shall be pre-"vented?"

Falls of coals and roof are the most frequent cause of injury. The deaths from these accidents alone have been 2,971 in eight years, or 371 a year. Besides those killed by coal falling upon them, a very much larger number have been maimed and injured, often very seriously.

It is probable that no reasonable degree of care will completely guard against these accidents, but it is certain that they may be very much diminished, as is proved by the fact that in the northern district, which employs one-fifth of the men, there are only about one-eighth of the fatal accidents of this class. This great difference appears to be chiefly owing to the plan adopted in the north of employing men for the especial duty of looking after the safety of the colliers. In the northern district, about one in six of the men employed are what may be termed the safety staff, for superintending ventilation, keeping up roads, setting timber, removing obstructions, and doing things necessary for the safety of the others. In most other parts of the country, colliers are expected to do most of these things themselves, and they are very much less properly done, with the effect of an annual loss of 126 lives more than there would be if the danger were reduced to the Durham standard; and the northern mines are themselves susceptible of great improvement.

The most dangerous part of the collier's employment seems to be in the shaft, for though most of them pass but a small portion of their time in or near the shafts, more than one-fifth of the deaths occur there. That many of these accidents may be guarded against, is proved by the fact that many of them occur which the most simple precautions would certainly have prevented. In instancing this Mr. Holland remarks, "men could not be killed by falling "stones or coals if the cages were properly "covered. Few are thrown out of the baskets "or skips, when cages with proper guide rods "are used. Few are drawn over the pullies "when there are proper indicators, signals, and "breaks, and when the engine driver's atten-"tion is not distracted by other duties. To "neglect such means of safety is penal, but they "are neglected, because their observance causes "expense and trouble, and is not evidently and "directly remunerative, though indirectly "highly profitable."

About one-sixth of the deaths, or 166 a-year, are caused by miscellaneous accidents, the chief of which are crushing by coal tubs, or by passing trains. Many of these are the consequences of bad discipline; the want of proper control to enforce obedience to rule. Some happen because the galleries through which coal trains pass are too low and too narrow. Some by the employment of machinery and horses, where hand putting, though dearer, would be less dangerous, and many, no doubt, from the reckless foolhardiness of the sufferers themselves. The young seem to be the peculiar victims of this class of accident, partly because they are chiefly employed in the galleries, partly from their want of experience and caution. About twice as many of the boys below 15 are killed, as is the proportion to the number of them employed.

The systematic inspection of collieries by Government officers has, doubtless, led to the introduction of many precautionary arrangements, and caused hundreds of human lives to be saved; but it has not produced all the improvement of which collieries are susceptible, and from the very nature of the case, as Mr. Holland points out, it never can. It was never intended that the Inspectors should be the substitutes for viewers, or mine engineers, who are so constantly employed by the owners of the northern mines (but not always elsewhere), to direct the general mining operations. If the Inspectors are to perform this duty, not only must their number be increased from 10 to at least a 100, but they must be invested with power enough to become in effect the real directors of the collieries in very important respects. Such an extension of the system of inspection and of Government control would evidently be highly impolitic, and quite at variance with our national feelings and habits. All that can be wisely attempted by penal law is to enforce such general regulations, and to compel the adoption of such precautions, as will guard against evident and almost universal dangers, leaving the details of management and the discipline of mines to those who alone can effectually execute such duties—those who employ and pay the men. This is Mr. Holland's view; and it is ours also. At the same time the reports of the Inspectors give ample proof both that precautionary regulations directed to be observed are very generally neglected, and that a very large proportion of the thousand annually killed are destroyed in direct consequence of such neglect; and this is confirmed, as we have seen, by the fact that in the northern districts, where precautions are best observed, the proportion of fatal accidents to the men employed is very much less than that in the whole country.

What, then, is to be done? Lives which might be preserved by reasonable and moderate precautions are now sacrificed; how shall we mend this state of things? how wipe away the reproach of it? It is not an easy thing to answer these questions wisely. But it is nevertheless very necessary to do so. The one explosion at Lundhill cost the proprietors nearly £20,000, and their work-people 189 lives. If the families thus impoverished had had annuities purchased for them, producing ten shillings a-week for ten years only for the family of each man killed, such annuities, at £200 each, would have cost £37,800. Here, then, was a loss of nearly £60,000 at a single blow, to say nothing just now of the unhappy men the marks of whose dead bodies were shown us in the pit in July last. The latter phase of the subject cannot be dealt with; the pecuniary part of it can, and in reference to it Mr. Holland makes the following proposals as a

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basis for further legislative action in the matter:—"The cost of *precautions*, and of acci-"dents which occur in spite of them, should be "borne by the consumers of coal. The loss "occasioned by accidents which might be "avoided but are not, should be borne by "those whose culpable negligence or cruel "parsimony was the cause of them." So far the matter is plain enough; it is very easy to recognise the justice of these proposals; but to give legislative effect to them is not so easy. Mr. Holland, however, does not stop short of this.

This just and beneficial result might be attained, he considers, by one of two plans:—by a system of insurance against death by accident, or by such an extension of Lord Campbell's Act as would secure compensation to the families of those killed apparently in consequence of the neglect of any of the precautionary regulations legally ordered to be observed, unless it can be proved that the death was caused by the deceased himself; instead of its being necessary, as it now is, for the claimant of compensation to prove that the death was caused by the direct act or default of the master, whereas it is generally the neglect of some servant or fellow-workman, who alone is pecuniarily responsible, but from whom substantial damages can rarely if ever be obtained. He thinks that proved neglect, the probable cause of the injury, should be *primâ facie* evidence that it was the real cause, and that coal-owners should compensate for injury suffered by those they employ, in consequence of breach of law either by themselves or their agents. The object would, however, he considers, be much more perfectly attained if no one were allowed to work in any colliery without being insured against death by accident, to a sufficient amount to secure his family from destitution; which would have the effect of compelling those to bear the loss who profit by the labour, and who can most control the result.

Mr. Holland contends for this proposition at great length, and with uncommon ability. He did not, however, convince all who heard him. Mr. Robert Hunt, F.R.S., Keeper of Mining Records, declared that he did not think a system of insurance would render the proprietors of collieries generally more careful as to the mode in which they carried on their operations. He "believed the proprietor's greatest interest was to "preserve the lives of his men; for he knew that "accidents happening in his mine were always "attended with great cost to himself." We think Mr. Hunt in this observation begs the real question at issue. No one doubts that it is "the proprietor's greatest interest" to preserve the lives of his men, or that he is ignorant of the fact that accidents happening in his mine are "always attended with great cost "to himself." But what is doubted is, whether mine proprietors really believe that to be to their interest—so believe it, that is, as to act upon their belief. We know they do not. The one fact of the Durham mines being so much better managed than the others proves that the proprietors in general have no living, operative conviction of this kind. They know, doubtless, that accidents, when they occur, are attended with great cost to them; but money loss from accidents *may not* be sustained, whereas the cost of precautionary measures *must* be borne if they are once adopted Mine owners are like most other people in this respect, and prefer the risk of a great loss to the certainty of a small outlay. Mr. Hunt further stated that the proprietors were always, in his opinion, open to conviction, and willing to adopt real improvements when the necessity for them was pointed out by the Government Inspectors. We doubt this, and think it would not be difficult to cite cases making strongly against it. If it be true, then the Inspectors must be the persons principally to blame for the excessive number of accidents in Yorkshire, Lancashire, Staffordshire, Wales, &c. Mr. Hedley, the Government Colliery Inspector for Derbyshire, spoke at the meeting, and coincided with Mr. Hunt's views, using like arguments with him. We dispute the reasoning of both; but we are willing to acknowledge that their want of confidence in Mr. Holland's insurance scheme may, nevertheless, be well founded.

The whole subject requires careful and prolonged consideration. The expression of hasty and unstudied opinions upon it can do no good. Mr. Holland deserves our best thanks for his paper upon it, especially for the fair and careful spirit in which it is conceived. Its delivery and publication, with the interesting discussion that followed it, must do good. The whole may be read in the Journal of the Society of Arts for December 2, 1859.

THE COMPASSES OF IRON SHIPS.

In completing our review of the Liverpool Compass Committee's Report, we come next to the subject of compass adjustment. Much difference of opinion has existed not only as to modes of adjustment, but also as to the propriety of attempting it mechanically in any way. Although this question may be considered as settled in practice, the Committee have not failed to give it their careful attention. They believed that in only one instance which requires to be named, besides that of the Royal Navy, is magnetic compensation dispensed with in iron ships, and that is in a line of steamers plying north and south for 1,200 miles on each side of the magnetic equator on the west coast of South America. The experience of the Committee proves that magnetic compensation is seldom so perfect as to dispense with the necessity for a table of deviations even in short voyage ships, while in ships making long voyages the change is frequently so great as to make a deviation table worthless, except for first clearing the land. This is more especially the case with steering compasses; and here the inconvenience complained of is as often want of *directive power* in the needle as the extent of the deviation or the difference between the indications of this compass and the standard. In almost all iron ships which sail round the Cape of Good Hope, perhaps in all which reach 40° south latitude and 40° east longitude, complaints are made of this. In the Great Britain, a temporary steering compass had to be fitted much higher than the one commonly used. In the Sarah Palmer the binnacle compass was quite useless, and a "vertical compass" fixed on the top of a companion, about seven feet above the poop, had to be fitted with lanterns so as to steer by it instead. Reports of seven or more points of deviation are not unusual from ships traversing this part of the world. After deduction has been made for variation of the same name being included with the deviation, as may sometimes be the case, sufficient remains to show that upon some courses the earth's directive power must be most materially diminished. Statements of a similar kind have been made respecting some of the North American steamers. In both localities the earth's directive or horizontal force is small, and when it is further reduced by the opposition of the ship's magnetism, it will readily be seen how weak must be the directive power which remains. Slight causes will then turn the needle aside, or a small roughness of the agate or bluntness of the pivot will prevent the card from traversing freely, perhaps from moving at all until it is entreated at a large angle; and then, by resting on the other side of the magnetic meridian, a report might next day arise of a sudden derangment of the compass from the ship being found forty or fifty miles on one side of where she was expected to be.

The want of directive power on some courses in uncompensated compasses is thought to be the strongest argument in favour of mechanical adjustment. The Committee's experiments on board the Royal Charter, with the deviations for her compasses obtained at Melbourne by the Rev. Dr. Scoresby, afford some interesting data. The Committee investigate the case of this ship at great length, and among other things they have arranged tables so as to contrast the deviations of the two compensated compasses with those of the Admiralty standard compass, both with and without magnets. After averaging the results of the three sets of experiments (not the most favourable mode of comparison for compensation by magnets), the ratios are:—

For the steering compass, 21 : 12 } in favour of
„ companion compass, 24 : 22 } compen-
„ Admiralty compass, 26 : 23 } sation,

even without any attempt to correct the original adjustment; and this is a new ship—one, therefore, subject to extreme changes. It is worthy of notice, say they, that adjustable magnets were fixed to the steering compass, but their position was not altered during the voyage, and most fortunately so, for otherwise the comparison could not have been so perfect. The result shows that had the compensating apparatus been employed, as was intended, the whole of the adjustment which was required is the following:—1. To screw the fore-and-aft magnets a fraction of an inch nearer the compass card at Melbourne, and to screw them back again a little as the ship returned to Liverpool. 2. To screw the transverse magnet (which was rather above the middle of its containing box) gradually lower and lower through the whole of the voyage until the ship's return to Liverpool, when it would probably be at the bottom of the case. Simple as this appears, it would thus have been possible to keep the steering compass correct, and to give the needle the full effect of the earth's directive power. This is possibly an extreme case, and the relatively small change in the steering compass may be due to its position so far forward as in front of the mizen-mast. In another instance of a compass placed very near the stern-post of an iron sailing ship, where the adjustable magnets were also applied and actually used, the following movements took place:—The three fore-and-aft magnets had to be gradually removed as the ship went south, and afterwards two were required placed the reverse way. In this condition the ship rounded Cape Horn. Before reaching Valparaiso one of these magnets was again removed. On the homeward voyage one fore-and-aft magnet, placed in the original direction, was sufficient while within the tropics; and another was required on reaching 40° north. Only one transverse magnet was in place when the ship left Liverpool. While in the southern hemisphere, a second was required in the same direction. On the ship's return, one magnet athwart-ship was found to be sufficient; but it had to be screwed to its highest possible position in the case. In the previous voyage (the ship's first), before the captain knew how to use his adjusting magnets, the deviations were so excessive that he had to remove the magnets altogether.

Though the various modes of compensation now in use are mostly founded upon the experi-

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ments and instructions of the Astronomer Royal, the Committee regret to find that several modifications are made by adjusters, which appear defective, and in some instances liable to produce much mischief. Some adjusters omit the chain-box or soft iron compensation for correcting the horizontal induced magnetism of the ship, and thus ignore the quadrantal deviation altogether. If tables of deviation were always given this would not be of much moment, but captains are sometimes led to believe that the adjustment is complete without it. Others attempt compensation who appear quite ignorant of its nature, and make vain efforts to correct a ship's attraction with permanent magnets only. Theory and practice combine to prove that when the chain-box compensation is once properly applied, no further change in it is required whatever be the voyage; and the Committee feel confidence in expressing the opinion that it should never be neglected. The chain-boxes at present in use are seldom large enough to correct more than 3° or 3½° of quadrantal error. They may with advantage be made of twice their present length. The increased length would also tend to correct a portion of the errors which generally arise from heeling. In many cases the Committee have observed the use of oblique, inclined, and vertical magnets in positions which must necessarily produce large errors when the ship heels. In one instance an error of four points was reported from this cause. The Committee object to the *ordinary* use of any but the horizontal compensating magnets, and would always have them placed fore-and-aft or athwart-ship—not only for the reasons already stated, but also because the oblique positions render any attempt at change while at sea by the captain more difficult, and make his attempts at compensation in the same way almost hopeless. Horizontal magnets, if placed *near* and *below* the compass bowl, may also have an injurious action, and possibly have given rise to some of the fluctuations in the deviations recorded of some floating compasses. One captain, when spoken to on the proximity of a compensating magnet to his steering compass, said he observed when it was first fixed how a small difference in its position affected the compass needle; yet he stated as a matter worthy of attention, that on one occasion when water from a rusty tank was used to float the compass bowl, the rust in the water so changed his deviations that he was obliged to take it out again. It had not occurred to him that the difference in the level of the bowl might have been the real cause. In this, as in many similar instances, the facts may be accepted when the explanations or alleged causes are inapplicable. When circumstances will not admit of the compensating magnets being placed a sufficient distance below the compass they should be fixed on the same level as the card.

The projection of deviation curves (to which subject we next come) has been recommended as a means of obtaining a table of probable errors on every point of the compass from observations made on a few points only. Napier's method of projection, or the modification of it by Captain Ryder, Royal Navy, is also extremely valuable for converting *compass courses* into *magnetic courses*, or the reverse. Sufficient attention to this, or even the knowledge that it is necessary, is exceedingly rare in the merchant service. Few captains or compass adjusters appear aware that considerable difference may exist in the deviation between ship's head by compass and ship's head true magnetic on the different points of the compass. It is neither taught to them nor noticed in any way in the examination for a certificate of competency. In many deviation tables it is left to be guessed whether "*ship's head by compass*" or "*ship's head true magnetic*" is intended. In nearly every instance they are given for "ship's "head true magnetic," the reverse of the practice of the Royal Navy. The projection of deviation curves is also useful to the initiated, for the purpose of testing the probable accuracy of the observations, and the care which has been taken in swinging ship. Some examples are given of this by the Committee: one may be taken as an instance. On noticing that the west deviations very much exceeded the east deviations in amount, while the curve showed general symmetry, it was conjectured that the "lubber line" was not towards ship's head. Examination proved this to be the fact, and showed that the binnacle (*as in many other cases*) was only secured by lanyards, and that through these having become slack "the standard "bridge compass" was "considerably slewed." It proved, too, that the ship had been swung with the binnacle in this position, and that she had so made the voyage from Bristol to Liverpool. This was also confirmed by a second swinging under the direction of the Committee. Though this careless mode of fixing a standard compass was pointed out to the captain, and he immediately gave directions to the carpenter to secure it with wooden cleats, the ship left England for the first time without its being attended to further than by "taking in the slack" of the lanyards. Similar cases have been observed. Compass records from such ships are entirely valueless.

Among the miscellaneous operations of the Committee may be noted the distribution of circulars conveying information as well as asking for it. Copies of some of these, with new editions of old ones, are appended to their Report. The Committee have also examined as far as possible all new inventions relating to the compass or compass management, and have considered various suggestions for facilitating the detection of compass errors at sea. No remarks have been made by the Committee upon the changes in the magnetism of iron ships produced by collisions at sea. Records of one or two cases have been obtained, and the attempt has been made to get others. It is difficult to obtain reliable evidence—not so much personal, as respecting the previous condition of the ship's compasses. In some instances iron work, so near as to influence the compass, has been carried away; in others the vessels have been in sight of port and the compasses were not noticed, while considerable repairs and alterations have been made before the ships again went to sea. In another case the steamer went her usual voyage in foggy weather after the collision, and nothing amiss was observed. Another steamer, ever since the collision by which an iron sailing ship was sunk, has been lying alongside other iron vessels, and the captain can offer no information.

The Liverpool Compass Committee, in concluding their able Report, delicately intimate to the Lords of the Committee of Privy Council for Trade that a better and perhaps more satisfactory view of one portion of the subject could be obtained in six months by the action of the Board of Trade than the Committee could hope to gain in a much longer period. "There is "more than an appearance of unfairness," says the Report, "in a number of private indivi-"duals requesting copies of deviation tables "and information of this kind from compass "adjusters and others, and then using the infor-"mation thus kindly granted to prove the "incompetence or carelessness of some of the "donors. Compass adjusters, the competent "and incompetent alike, already suffer from "imputations which do not attach to them." A sufficient degree of information on this intricate subject can scarcely be expected at present from the merchant captain, or he might superintend and control the operations of swinging ship and adjusting compasses in the same way as he does any other duty which devolves upon him. Even where an interest is felt in the subject, the great demand on a captain's time, at the busy period of fitting for sea, usually prevents him from doing more than inquire the errors on one or two particular courses, and to charge the adjuster "not to compensate her too "much," as he does not like "too much com-"pensation." As to the general distribution of the ship's magnetism, or the real nature and direction of the force which will be constantly pulling at his compass needle, perhaps neither he nor the compass adjuster has any adequate conception. In some cases the captain will stand by in a sort of selfish spirit and see that everything is done which the compass adjuster requires, but will abstain from making any remark or expressing an opinion, so that if perchance anything goes wrong afterwards the whole of the blame may be thrown upon the adjuster; or if this expression be too personal, that the fault may be placed upon "the com-"passes." Until masters are competent to attend fully to the subject, some kind of authoritative supervision in this matter would undoubtedly be beneficial; but the Committee confine themselves at present to showing how proof of this may be obtained. Copies of all deviation tables which may be given both for adjusted and non-adjusted compasses; particulars as to the number, direction, and distance of the magnets which may be applied for compensation; and the amount of original error on two cardinal points 90° apart, would afford ample information to any one competent to examine such returns on nearly all that requires to be known on this part of the subject. Information somewhat of this kind was collected for a short period by Mr. Towson, of the Local Marine Board, and Mr. Hartnup, of the Liverpool Observatory, under authority from the Board of Trade. From such data correct inferences may be drawn as to:—1. General ability of the adjuster. 2. Whether the ship was properly swung. 3. Approximate amount and direction of ship's magnetism at the position of each compass. 4. To what extent compensating magnets are placed in positions which are known to produce great and variable errors on the heeling of the ship. 5. By returns from the same ship each time she is swung or re-adjusted; information as to the changes which may occur in her magnetism. Returns similar to those which have been suggested can cause no delay, or in any way interfere injuriously with the captain, the merchant, or the ship-owner, while they would afford some sort of guarantee to each that an important subject is being adequately cared for. It must also be evident that occasionally, in cases of accident, these records would afford valuable evidence.

In a future article on this subject we shall complete what we have to say by a reference to some facts recently made public by Professor Airy, the Astronomer Royal.

It is useless to discuss at present the question at issue between the directors of the Great Ship Company and Mr. Scott Russell, because the whole business is before the three gentlemen who were fixed upon as arbitrators when the contract was undertaken. The Great Eastern is the first example we have met with of a costly ship being systematically and unjustly depreciated by those who should be the last to undervalue her.

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Proceedings of Societies.

SOCIETY OF ARTS.

Nov. 25.—The paper read was on "CHINA, and its relations to British Commerce," by Sir JOHN BOWRING, F.R.S. After dealing at considerable length with the broad features of his subject, Sir John proceeded to remark upon the stationary character of the Chinese, and spoke as follows:—"Looking into the early history of China, I find that 4,000 years ago the art of drawing was thoroughly understood, that mountains were levelled, that valleys were raised, and that agriculture was carried on in a state of perfection, beyond which it has not progressed a step. I find that 2,200 years before Christ, the Chinese people were clad in silk; and there is a very ancient proverb which says it is an opprobrium to a man who, having reached the age of fifty, does not possess a silk garment. I lately stumbled upon a passage in a history of the second century, in which I found a description of the manufacture of paper in all its detail, from rags reduced to pulp, and which, by pressure, were made to give a paper upon which the Chinese were in the habit of writing, while it is notorious that in Europe the manufacture of paper was contemporaneous with the invention of printing, and, perhaps, more important than the invention of printing itself in the advancement of civilisation. Many of the discoveries which are modern in Europe are ancient in China. It is impossible to say when the Chinese had *not* the printing art. The mariner's compass, it is notorious, was possessed by them hundreds and hundreds of years before we had any knowledge of it. There is a description even of iron boats and rotatory paddles at a remote period. Every one knows of what antiquity is their beautiful porcelain. So far from progression, I am sorry to say that these arts are in a state of decadence in China, and the value of porcelain is now estimated by its age. In consequence of some porcelain having been found, either in the pyramids or in the ruins adjacent to them, it was maintained that there must have been intercourse between China and Egypt, and that these, bearing as they do undoubtedly Chinese inscriptions, and being filled with cosmetics or perfumes, or with the valuable produce of the East, contained evidence of the existence, not only of the Chinese language three or four thousand years ago, but of intimate relations between India and China. The fact led to investigation, and we were enabled to trace in the poets of China every inscription that was found upon these curious porcelain jars; and this showed that they could not have had an earlier existence than the period at which these poets lived, which was between the eighth and the tenth centuries, certainly a very curious and not uninteresting fact. While I feel how much backwardness there is in China, and that in many matters there is a great deal to learn, I know that we might communicate to them much very valuable knowledge. The only instance in which, so far as I know, they have generally adopted the improvements of the West, is in the general use of fire engines, which are found in many of the principal cities in China, and which are worked with very great activity and dexterity. China, I think, might teach us something in other matters. In a collection that I made for the town of Sheffield, it was discovered that they had the art, I believe wholly unknown in Europe, of hardening brass to the consistency of steel; and there are brass instruments made in China at this moment of exceeding delicacy, that have all the power which we give to steel. I think also that something is to be learnt in the chemical field of inquiry. Many of the colours of China are very superior to those of Europe. There is one colour which has led to some curious investigations, namely, a perfect vegetable green. They have a green indigo, which is a permanent colour. Now I believe up to the present time we have never been able to make a green which will resist all the changes of temperature and climate. I have suggested, on two or three occasions, when I have had the opportunity of giving advice, that it is exceedingly important, now that China is likely to be opened to European inquiries, that intelligent persons should be sent there, in order to see whether, from the experience of these forty centuries, something might not be gathered up that is of practical value. Intercourse may lead to the removal of many of their prejudices, but without that intercourse it is impossible to alter the stereotyped character of the Chinese. They treat us with disdain, and often with perfidy; but they are all educated under the idea that we are no better than 'barbarians,' and that we ought to be dealt with as if we were wild beasts Such are the teachings of their philosophers, who represent that the world is divided into two great portions, that its centre is under the canopy of Heaven—the ordinary name which they give to their country—all civilisation being under this canopy, and that besides this there is the barbarism which is beyond. We represent that barbarism; and in discussing the matter with the Chinese, they say, 'You are great fighters; you have attended to the art of war, and we have not, but you have no civilisation; you have no language that is intelligible. It is true, you are taught to write, but then we see a man who comes from a nation of three or four millions of people, and on the other side of the water there is another nation of three or four millions, and the writing of the man on one side of the river is given to a man on the other side of the river, and he cannot make out a word of it.' They say, 'We are three or four hundred millions of people who cannot, indeed, understand one another's talk, but everybody understands what everybody writes.' I never found a Chinaman embarrassed when he met a man from a distant province, for though their spoken idioms are different, their written signs are identical. Failing to be understood in speech, the Chinaman makes a mark on his hand, and he is understood immediately. The Chinese often taunt us with the imperfection of our education and the narrow scope of our language, and in this respect deem us inferior to the natives of Japan, Corea, or Siam, who can read the Chinese character."

INSTITUTION OF CIVIL ENGINEERS.

Nov. 22, 1859.—Joseph Locke, Esq., M.P., President, in the chair.

The whole of the evening was occupied by the discussion, commenced at the last meeting, upon Mr. Amos' Paper, "ON THE GOVERNMENT WATER WORKS, TRAFALGAR SQUARE."

Nov. 29, 1859.—Joseph Locke, Esq., M.P., President, in the chair.

The paper read was "ON ARTERIAL DRAINAGE AND OUTFALLS," by Mr. R. B. Grantham, M. Inst. C.E.

The author commenced by giving an extract form Mr. Simpson's address, delivered in January, 1854, describing the general state of many important districts, in which property to a large amount was rendered useless, from the want of a proper system of arterial drainage, and of the improvement of the trunk lines, or principal water-courses. The legal difficulties in the way of carrying out works of this character, led the author to think that some general legislative measure was necessary—such as Earl Carlisle's Bill, proposed in 1852, which, in his opinion, was the best that had been suggested—before the great object of improved arterial drainage and outfalls could be attempted on a comprehensive scale, or be effectively maintained in working order.

The subject was treated under the following heads:—First, attention was called to some of the evils arising from the want of a combined system of operation. Secondly, an account was given of the impediments which exist to prevent the adoption of arterial drainage. Thirdly, the class of works necessary to be carried out was described. And, lastly, some of the leading principles in the construction of drainage works, to accomplish the object in view, were pointed out.

The paper then went on to state, that there was, perhaps, scarcely a district in this country where one of two conditions did not exist; either the lands could not be drained at all, or they were injuriously affected by the drainage of those above them. Instances were given in illustration of these two conditions; and it was remarked that, in many cases, a single person, who was unwilling to drain his property, might prevent any improvement by adjoining owners.

Owing to the extensive system of subterranean, or pipe drainage, and to the field drains and ditches being better cleared out than formerly, there had been a large increase in the water flowing down rivers, brooks, and minor streams. The effect of this was, that the water was discharged in a shorter time, causing more frequent floods, as the brooks and streams were of inadequate size; and at other times, the rivers and streams contained less water than formerly, in many cases not sufficient for the supply of the towns and country dependent on them. To give some idea of the magnitude of this system, it was stated that, within the last ten years, about four millions sterling had been expended in the drainage of 800,000 acres, under the control of the Inclosure Commissioners of England; and it was estimated, that probably twice that umount had been laid out by the Crown, by corporate bodies, and by private individuals. For full details of the progress and results of the underdrainage of land in Great Britain, the members were referred to Mr. Bailey Denton's paper, read before the Society of Arts in December, 1855.

The tendency of mills, weirs, dams, and other obstructions in rivers, as well as the crooked and confined channels of the rivers themselves, to impound the upland waters, was next adverted to. And, on the other hand, the injury which lands suffered, by being inundated by the drainage of the uplands, from the want of combination among the possessors of property, was shown. Both these cases were illustrated by a proposed drainage in the vicinity of Wareham, Dorsetshire.

The impediments which at present exist, to prevent arterial drainage being carried out on a combined system, were attributed mainly to the state of the law; which required to be modified and changed, and its powers enlarged and liberalised, as had been previously stated. The points which more immediately concerned the Engineer were, the straightening and deepening both internal and tidal rivers, and the removal of mills, dams, weirs, and other obstructions, in order to produce uniform inclinations towards the outfalls of streams. The gradients, or inclinations, must be adapted to the soil through which the rivers flow, to obviate the scouring action of the water on the banks and bottoms of their courses. It was also necessary to impound the surplus water, so as to preserve an uniform minimum supply to the channels of rivers at all times; to provide works available to take off field drainage, and for the irrigation of adjoining lands, for the re-construction of bridges and culverts under public roads, and for the application of the water to the supply of towns and villages, which, in many instances, might be altogether deprived of their supply by any through system of drainage.

The arterial drainage and outfall works executed in Ireland since 1846, the year of the famine, were then alluded to, as forming the best examples of such works in the United Kingdom. Probably the largest work in the world, in reclaiming an extensive area of country from the effects of stagnant water and floods by arterial drainage, was that in the Fen Districts, commonly called the Bedford Level, to which attention was next directed at great length. The author then referred to the means adopted by the Norfolk Estuary Company for the reclamation of land; and next to the Ancolme Drainage, an account of which was presented to the Institution in 1845, by Sir John Rennie. In this paper, as well as in all that had been introduced relative to the Fen district, some of the leading principles of the drainage of level areas, and of improving rivers in flat countries, were noticed. These were, first, the formation of catchwater drains for intercepting

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highland waters; secondly, separating, as much as possible, navigation from drainage, in improving rivers; thirdly, the slopes, or inclinations that the bottoms of rivers, or newly cut drains, discharging into tideways, should be formed to; fourthly, the depth at which the cills of outfalls into tideways should be laid; and lastly, the formation of overfall weirs and reservoirs, for the retention of mud and sand. Some large drainages in Yorkshire were then referred to, and it was mentioned that an estate of about 2,250 acres, at Thornton, near Pocklington, was at this time suffering considerable injury from the want of facility for draining the water from it. When Hainault Forest, lately a Royal Forest, was disafforested in 1853, the allotment made to the Crown contained about 2,000 acres. This consisted of a level plain, part of which was known as Fairlop plain, lying at the foot of a ridge of land sloping towards the south. Another ridge projected into it from the east, and at the foot of these ridges were valleys, which brought down the water from beyond the limits of the Crown allotment. The first operation in the reclamation was that of making the roads and arterial drains. The three principal valleys were the Dog Kennel Brook, extending from Little Heath, on the southern boundary of the allotment, to the northern boundary, where it branched towards the north-east, the Well Ridden Brook, branching off from the Dog Kennel Brook about half a-mile from Little Heath, and towards the north-east—and a main drain, on the opposite side, which received the drainage of the west and north-west parts of the allotment, and of the lands to the north of it. In each of these valleys, regular open drains had been formed, into which all the pipe drains were discharged. The Dog Kennel drain was 6 feet wide at the bottom, and from 4 feet to 5 feet deep at the outlet; the bottom width, diminishing gradually to 2 feet at the upper end. The inclinations were 1 in 528 for the lower part, and from 1 in 125 to 1 in 200 for the upper part. The natural fall of the valley was steeper than this. Therefore overfalls, varying from 3 feet to 10 feet in width of opening, and from 3 feet to 5 feet rise, were constructed of brick-work at different points. These were capable of being made into dams, by inserting boards into grooves, for storing water in dry seasons, for cattle or other purposes, and for irrigating the land on both sides. The system adopted was to have as few open drains as possible, and large mains. The area of land gained for profitable cultivation was thereby increased, and the labour of tillage reduced. It was found that the agriculturists neglected the mouths of under drains, if they were numerous, so that it was good economy to reduce the number to a minimum. This forest, which, from time immemorial, had been almost a waste, was now a valuable farm; and what was formerly a refuge for thieves and poachers, now afforded the means of profitable employment to many persons.

The author then proceeded to refer to the manner of dealing with rivers in India and in Northern Italy, quoting, principally, from the published works of Capt. Baird Smith, M.E., and Paul Frisi. The tanks or reservoirs which abounded in the Madras Presidency might, it was believed, be connected with arterial drainage works, especially in rapidly inclined countries, and be useful as aids to agriculture, and for the supply of towns. In upland or internal rivers and streams, such as those last alluded to, the leading principles to be observed in their improvement were—first, straightening the channels from the source to the outfall; secondly, making them of sufficient width to include all the flood waters, having regard to the inclinations; thirdly, the formation of shallow, rather than deep drains, in nearly all kinds of soils; fourthly, the regulating or adjusting the inclinations of the bottoms, so that the velocity of the water might be checked, to prevent the erosion of the sides and bottoms, and the removal of the gravel, sand, and mud to the lower levels; and lastly, providing the means of storing up the water in reservoirs or tanks, apart from drainage, at convenient points, for agricultural and industrial purposes.

The paper concluded by noticing the Commissioners of Sewers, first instituted in the reign of Henry VI., who were acting in every part of the country, having jurisdiction on the borders of the sea or tidal rivers. Their duties were to repair sea or river banks, and to keep the main drains and outfalls of level districts in repair, and clear them for the passage of water. Their powers were not sufficiently extensive, and it was stated that their constitution would have to be remodelled in the event of any fresh legislative measure being carried upon this subject.

Dec. 6, 1859.—Joseph Locke, Esq., M.P., President, in the chair. The discussion upon Mr. Grantham's paper "On Arterial Drainage and Outfalls" was continued throughout the evening; but, as it was not concluded, the publication of the abstract is deferred.

It was announced that the Annual General Meeting would be held on Tuesday, December 13th, when the annual report would be read, and the ballot for the President, Vice-Presidents, and other Members of Council, would take place.

At the monthly ballot the following candidates were balloted for and duly elected:—Messrs. A. C. Crosse, W. H. Purdon, and W. Stanley, jun., as members; Messrs. J. Aird, jun., E. Cottam, W. H. R. Curll, J. B. Dunn, I. Evans, J. Fisher, jun., F. Jenkin, J. Kimber, I. H. Latham, J. F. Stokes, J. Taylor, and I. Thwaites, as Associates.

ROYAL GEOGRAPHICAL SOCIETY.

A crowded meeting of this Society was held on Monday evening, at Burlington House; Sir Roderick I. Murchison, Vice-President, in the chair.

Presentations.—The Hon. Robert Marsham, William Fryer, and George Lee, Esquires, were presented on their election. Numerous noblemen and gentlemen were elected fellows, and others proposed. The chairman announced that he had that day received from the Duke of Newcastle a notification of the safe arrival of the British North American Expedition under Captain Palliser at Fort Colville.

Sketches in Burmah, Punjab, Himalayas, and Kashmir, by Captain H. H. Godfrey Austen, F.R.G.S.; Sketches of the Scenery, &c., on the Zambesi, by Thomas Baines, F.R.G.S.; Photographs of Ancient Hindoo Temples, by W. H. Purdon, F.R.G.S.; Sonnenstern's Map of Central America, &c., were exhibited to the meeting.

The papers read were:—

1. Sun Signals for the Use of Travellers. By Francis Galton, F.R.G.S.—If a piece of looking-glass be held in such a position that a person at a distance can see some portion or other of the sun's disc reflected in it, it assumes the appearance of an exceedingly brilliant star of solar light. The object of Mr. Galton's invention has been to provide an optical arrangement by which the signaller may know whether he is holding the mirror aright. The smallest size of hand heliostat can literally be carried in the waistcoat pocket, yet, by its means, whenever the sun is shining, a signal can be instantly made that shall be visible to the entire neighbourhood of any given spot within sight. A distance of twelve miles, on a day of average clearness, is well within the power of this little instrument. If the flash be replied to, a regular communication can be carried on, in which the signals are varied by gentle movements of the hand that causes the flash to be seen and to disappear; alternately words and sentences are communicated by a notation of long and short flashes identical with the notation of long and short beats that is used in Morse's electric telegraph; but, independently of this more refined sort of telegraphy, the mere power of calling attention from great distances, and of conveying three or four simple signals, such as a series of single flashes for affirmation, and of doubles for negation, is of the highest consequence to a traveller. The principle of the instrument and the intensity of the flash, under varying circumstances, were explained in detail, and a number of hand heliostats, some of them made for Mr. Galton, by Messrs. Troughton and Simms, were laid on the table. Sir Edward Belcher and the Astronomer Royal of Cape Town testified to the enormous distance at which heliostatic lights were visible when employed in triangulating a country.

2. Latest accounts from the Central Africa Expedition from Dr. Livingstone, F.R.G.S., with Illustrations.—Dr. Shaw remarked that, as the papers were very voluminous, a few only of the more interesting extracts could be read. The first portion, dated May 12, 1859, and addressed to the Earl of Malmesbury, gave an account of Dr. Livingstone's journey to Shirwa, a large inland lake. The lake in its wide part might be from 25 to 30 miles in breadth, and was of a pear shape; only the narrow portion was prolonged some 30 miles south of the body where the travellers stood. There was an inhabited mountain island near the beginning of the narrow part. Its length might be from 60 to 70 miles, not including the southern narrow portion of 30 miles. The height of the lake above Chibisa Island, where they left the ship, was 1,800 feet, and 2,000 feet above the level of the sea. Mount Zomba, in its neighbourhood, was 6,000 feet high. The whole region was well though not densely peopled. The Portuguese did not even pretend to know Shirwa. Frequent inquiries were made of the natives as to whether any white men had ever visited them before, and they invariably replied in the negative. Dr. Livingstone, therefore, claimed the first discovery for himself and party, although the Portuguese took the honour for themselves. The Manganya cultivated the soil very extensively, and more men than women were sometimes seen at this occupation. The soil was very rich, the grass generally from six to eight feet long. A few yards' distance often completely hid a companion, and guides were always necessary. Gardens were common high up the hills and on their tops. Cotton was cultivated extensively, and the farther they went the crop appeared to be of the greater importance. The women alone were well clothed with the produce, the men being content with goatskins and a cloth made of the bark of certain trees. Every one spun and wove cotton. Even the chiefs were to be seen with the spindle and distaff. The process of manufacture was the most rude and tedious that could be conceived. Almost every village had a furnace for smelting black magnetic iron ore. A people to the N.N.W. had manufactured a rude imitation of a pistol, which they fired only on occasions of mourning. They were not aware that it could propel a ball.

Another paper was also read on the navigation of the Zambesi, which he stated to be *navigable*. In ascending the river they burned no less than 150 tons of lignum vitæ to generate steam, the value of which, at London prices, was £900. In the midst of great disadvantages they had travelled upwards of 2,350 miles of river. From October, 1858, to June, 1859, 5,782 elephants' tusks had gone down the Zambesi from Tete alone. Two-thirds of these were large, or upwards of 30lb. each, and the weight of the whole was 100,000lbs. The merchandise was conveyed in unwieldy canoes, which cost from £60 to £70 each. The Americans were absorbing all the trade of the east coast below Zanzibar.

The President also read extracts from letters which had been addressed to himself, and announced that he had the assurance of Lord John Russell, the Foreign Secretary, that every aid which he could afford would be given to Dr. Livingstone.

An animated discussion followed the reading of the paper, in which the Astronomer at the Cape, Mr. Crawfurd, Mr. M'Leod, and Captain Bedingfield joined; and

The chairman, in adjourning the meeting to the 12th December next, stated that there was another and very important paper on the list, on "The Trigonometrical Survey of Kashmir," the original MS. of which, by Captain Montgomerie, F.R.G.S., was suspended in the room; but as the hour was already advanced, the subject would be postponed until the ensuing meeting.

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GEOLOGICAL SOCIETY OF LONDON.

Nov. 30, 1859.—Prof. John Phillips, President, in the chair. Sir Walter James, Betshanger Park, Kent; George Dawes, Esq., Milton Ironworks, near Barnsley, Yorkshire; the Rev. Julian Edmund Woods, Penola, South Australia; Bassett Smith, Esq., 1 Elm Court, Temple; Captain — Hickens, Bengal Engineers; Lionel Brough, Esq., one of H.M. Inspectors of Coalmines, Clifton; John Studdy Leigh, Esq., St. Stephen's Terrace, Bayswater; and John Pope Hennessy, Esq., M.P., were elected fellows.

The following communications were read:—1. "On some Bronze Relics from an Auriferous Sand in Siberia." By T. W. Atkinson, Esq., F.G.S. 2. "On the Volcanic Country of Auckland, New Zealand." By Charles Heaphy, Esq. Communicated by the President. 3. "On the Geology of a part of South Australia." By T. Burr, Esq. From the Colonial Office. 1848. 4. "On some Tertiary deposits in South Australia." By the Rev. Julian Edmund Woods. Communicated by the President.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, Nov. 29th, 1859.—Dr. R. A. Smith, F.R.S., Vice-President, in the chair. A letter from Mr. Dyer was read relative to Mr. Jevon's paper. Mr. Dyer is led to conclude, from the facts which have been ascertained respecting the distribution of gold, that that metal forms a great part of the material of the earth's crust now in an incandescent state.

Mr. F. O. Ward laid before the Society an instrument termed a PSEUDO-DIASCOPE, and a paper setting forth its construction and use, and the principle it is designed to illustrate. By means of this instrument an aperture transmitting light is made to produce on one eye an isolated impression, while the other eye is directed to an opaque body, such as the hand held before it. The image of the aperture is then found to be transposed, and its perception ceases to be assigned to the eye by which it is really seen; the effect being that a perforation appears in the opaque body, through which the light seems to shine upon the eye by which this is viewed. The principle illustrated by this instrument, according to the author's view, is the essentially goniometrical and deductive nature of the visual act, whenever the distances of bodies are perceived, and their relative positions in space assigned. A Pseudo diascope was presented to the Society by the author, and the singular illusion produced by it was verified by the members present.

Mr. F. O. Ward subsequently laid before the Society a plan of his for diminishing THE LIABILITY OF POWDER MILLS TO EXPLOSION, and referred to a correspondence between himself and Dr. Faraday on the subject. The plan in question consists in supplying to those portions of powder mills in which the powder is treated dry, an atmosphere incapable of supporting combustion—preferably carbonic acid gas—so as to obviate the danger of explosion so far as it arises from chances of ignition *ab extra*—as by the spark from a workman's pipe, of which an example was cited. The danger of explosions from the liberation of oxygen from the powder itself, by friction or otherwise, would of course remain; but this the author inclines to believe is a less frequent cause of explosion than ignition *ab extra* occasioned by the carelessness of workmen rendered indifferent to risk by long habit and emboldened by impunity. Dr. Faraday, in his comments on this plan, approves it as adapted to cut off one class of risks, and so to remove the point of danger further off, and also as not likely to deteriorate the quality of the powder immersed in the protective atmosphere. He points out, however, as a source of danger usually unsuspected, the possibility of the ignition of the gunpowder dust which collects on the beams of powder mills, and by which, he believes, explosions may be originated, as well as by the heating of the grains actually under trituration in the mill. Mr. Ward, in reply to Dr. Faraday, recognises the partial nature of the security afforded by the proposed plan, but lays stress on the fact that it appears adapted to eliminate all the risks of the manufacture, except those which are inherent in the nature of the material operated on, and therefore essentially incurable.

A paper entitled "SUPPLEMENTARY RESEARCHES IN THE HIGHER ALGEBRA," by James Cockle, M.A., F.R.A.S., was read by the Rev. Robert Harley, F.R.A.S.

A paper was read by J. P. Joule, LL.D., F.R.S., entitled "EXPERIMENTS ON THE TOTAL HEAT OF STEAM."

The author showed that what is called the total heat of steam, or the quantity liberated when steam is condensed into water of 0° centigrade, consists of, 1st, the true heat of evaporation; 2nd, the heat due to the work done on the steam during the condensation; and, 3rd, the heat liberated by cooling the water from the temperature of condensation to the freezing point. The determination of the total heat of steam had been made the object of a very careful and elaborate research by Regnault, but it appeared to the author that independent experiments conducted in a different and more direct manner would not be without interest. The following is a summary of the results obtained by him compared with those of Regnault:—

Total pressure of steam in inches.	Total Heat in Degrees Centigrade.	
	Author.	Regnault.
37·25	638·43	638·77
57·52	644·77	642·87
111·58	655·45	649·06

A paper was also read by Dr. Joule, entitled "ON A METHOD OF TESTING THE STRENGTH OF STEAM BOILERS."

The author adverted to the means hitherto adopted for testing boilers. 1st. That by steam pressure, which gives no certain indication whether strain has not taken place under its influence, so that a boiler tested may subsequently explode when worked at the same or even a somewhat less degree of pressure. He trusted that this highly reprehensible practice had been wholly abandoned. 2nd. That by hydraulic pressure obtained by a force pump, which does not afford an absolutely reliable proof that the boiler has passed the ordeal without injury, and moreover requires a special apparatus. The plan which had been adopted by the author for two years past with perfect success was free from the objections which applied to the above, and is as follows:—The boiler is entirely filled with water. Then a brisk fire is made in or under it. When the water has thereby been warmed a little, say to 70° or 90° Fahrenheit, the safety valve is loaded to the pressure up to which the boiler is to be tested. Bourdon's or other pressure indicator is then constantly observed; and if the pressure, occasioned by the expansion of the water, increases continuously up to the testing pressure without sudden stoppage or diminution, it may be safely inferred that the boiler has stood it without strain or incipient rupture.

In the trials made by the author, the pressure rose from zero to 62 lbs. on the square inch in five minutes. The facility of proving a boiler by this method was so great that he trusted that owners would be induced to make those periodical tests, without which fatal experience had shown that no boiler should be trusted.

Microscopical Section, Nov. 21st, 1859.—Messrs. J. Lynde and A. Brothers exhibited the process of photographing microscopic objects as used by them, and which, from the specimens produced, appears very excellent. Mr. Parry described a simple form of camera which he had used, and in which he dispensed altogether with the use of the microscopic body, simply inserting the object glass into the lens aperture, and fixing a suitable stage to support the object. Messrs. Lynde and Brothers stated their intention of attempting to photograph thicker and more opaque objects; and Mr. E. W. Binney promised to supply them with sections of fossil woods, which he said had been drawn by artists, but with poor success, as the tendency of draughtsmen was to make them too sharp in outline, the objects losing their characteristic appearance by over definition.

ASSOCIATION OF FOREMAN ENGINEERS.

The ordinary monthly meeting of the Association of Foremen Engineers took place at their rooms in the City of London on Saturday night last, and was very numerously attended, notwithstanding the inclemency of the weather, and the fact that its members are located—many of them—at considerable distances from their very central place of assembly. The minutes of the November meeting were first read and confirmed, several elections followed, and after the reading of a letter from Colonel Dixon, of Enfield Lock, expressive of his high regard for the Association, and his regret at not being able to attend this particular meeting, Mr. C. F. Hayes proceeded with his concluding paper on the manufacture of the Enfield rifle. He said that he had on previous occasions endeavoured to explain the mode of preparing the various components and furniture of the long Enfield rifle and of the bayonet, and that he had now arrived at the *lock* and *stock* of the weapon. Upon the table lay the various parts of a rifle lock in the forged and finished stages, and a walnut-wood stock, as it left the machines which had shaped, mortised, drilled, and grooved it. These, together with some of the standard gauges used at the small-arms factory, and some exquisite photographs of the various machines at that place, assisted Mr. Hayes materially in his explanations. The *hammer* was the first item alluded to; this was of wrought-iron roughly forged by hand, and then struck by force of a Nasmyth steam drop into a pair of dies; afterwards it was annealed and forced through a cutting-press, which removed the superfluous metal squeezed out between the forging dies. A series of operations followed amounting in all to twenty-six, and in each of which great care had to be observed. The *lock-plate* was of wrought-iron. It was brought nearly to its proper form in a rider forging machine, and then struck at a welding heat into a die. Next, eight holes were drilled through it for the purpose of attaching to it the various pins, springs, &c., which go to make the lock complete. James Gunner, Esq., had greatly improved the apparatus used in shaping and finishing the lock-plate, and he very deservedly filled the post of inspector of small arms at Enfield. Very soon the lock-plate would be finished from the anvil without the intervention of hand labour at all. After case-hardening, the plate is tested by standard gauges, to be assured that there is no distortion, and, if found perfect, is ready for "assembling," that is, for being united with its fellow-portions of the rifle. The *tumbler* was a very important part of the lock, and was made of cast-steel. Much attention was requisite on the part of the workers in dealing with this, lest the heats taken upon it should alter and deteriorate the character of the metal used. Improved copying machines were now employed in the completion of this portion of the weapon, and after a variety of minor but yet consequential processes, it was finally hardened and tempered. Mr. Hayes here explained that the labour-saving machines invented by himself, and pertaining principally to the construction of the several parts of the lock, had saved from two to four thousand pounds per annum to the country—a rather important announcement. The *sear* and the *sear spring* were next referred to, and the manipulations necessary for their perfecting—minute and numerous—were explained with an elaborateness of detail which prevents our following the reader of the paper through his account of them. Finally, the sear spring is tested by pressure in a *Salter's spring*, and if found satisfactory, passed for service. The *swivel* is a small affair, but of some moment to the action of the lock. It is cut from a bar of 5-16th square steel, and after being milled, and faced, and drilled, and hardened, and tempered, it takes its place as a finished article. The *bridle* governs the movement of the lock, and is of great consequence, therefore, to the rifle. It is of wrought-iron got up by stamping, and milling, and cutting, and

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trimming, which, aided by some excellent gauges devised by Mr. Barnes, enables the workman to turn it out of hand expeditiously and well. The *main-spring* was of the best cast-steel, and it was needless to say, observed Mr. Hayes, that the skilled workman must exercise his utmost skill and judgment in dealing with it. This brought the reader of the paper to the manufacture of the *stock* of the rifle, which was of walnut wood—a material imported largely from Lombardy for this particular work. Copying machines, the idea of which was no doubt gained originally from Mr. Blanchard's lathes for turning irregular figures in wood, such as boot trees, &c., &c., were the principal media employed in converting a roughly sawn piece of walnut tree into a handsome and mathematically true-shaped bearer of the barrel, lock, and other fitments of the rifle musket. Space forbids our going minutely, as Mr. Hayes did, into the action of the shaping and cutting machines used in the preparation of stocks for muskets; we can only say that they do their work with unerring accuracy, and that there is no chance of any portion of the steel, iron, or brass attachments *misfitting* their places after the machines have done their offices. The interesting paper was brought to a conclusion by a summary of the number of operations performed in the perfecting of a rifle musket being given, and these amount in all to 769! A vote of thanks, proposed by Mr. W. Keyte, seconded by Mr. Briggs, and strongly advocated by the President, Mr. Joseph Newton, of the Royal Mint, was next given to Mr. Hayes, who expressed his acknowledgement of the honour conferred. The announcement of a paper for the January meeting—Saturday the 7th proximo—by Mr. Beckley, on "The Instruments used at the Royal Observatory, Kew," closed the proceedings.

MEETINGS FOR THE ENSUING WEEK.

MON.—*London Inst.*, "On the Radiation and Absorption of Heat," by Prof. John Tyndall, F.R.S., at 7 p.m.

Royal Geographical Society, I., "Kashmir, on the Physical Configuration of the Valley of," by W. H. Purdon, Esq., F.R.G.S., Executive Engineer, Punjaub, communicated by Sir Chas. Wood, India Office; II., "British Columbia, journeys in the Districts bordering on the Thomson, Frazer, and Harrison Rivers," by Lieuts. Mayne, R.N., and Palmer, R.E., and Chief Justice M. Begbie, communicated by the Duke of Newcastle, Colonial Office, at 8.30 p.m.

TUES.—*Inst. Civil Engineers*, Annual General Meeting, at 8 p.m.

WED.—*London Inst.*, "On the Physical History, Structure, and Materials of the Earth," by E. W. Bradley, Esq., F.R.S., at 7 p.m.

Society of Arts, "On the Great Eastern," by Mr. William Hawes.

Royal Geological Society, I., "On some Bones of Polytychodon, from the Chalk of Dorking," by Prof. Owen, F.G.S.; II., "On some new Reptilian Remains, with Shells of Pupa and an Iulus from the Coal-measures of Nova Scotia," by Dr. Dawson, F.G.S.; III., "On some Fossils from Bahia," by S. Allport, Esq.; IV., "On some Cheirotherian Tracks in the Upper Keuper of Warwickshire," by the Rev. P. B. Brodie, F.G.S.

THU.—*Royal Society*, at 8 p.m.

FRI.—*London Inst.*, "On Certain Principles of Vegetable and Animal Chemistry," by S. A. Malone, Esq., F.C.S., at 7 p.m.

Law Cases.

WILD'S PATENT FISHES FOR RAILWAY JOINTS.

COURT OF QUEEN'S BENCH, DEC. 3.—(*Sitting at Nisi Prius, before Lord Chief Justice Cockburn and a Special Jury.*)

HARWOOD AND OTHERS *v.* THE GREAT NORTHERN RAILWAY COMPANY.

Mr. Knowles, Q.C., Mr. Grove, Q.C., Mr. Hindmarch, and Mr. Webster appeared for the plaintiffs; and Mr. Bovill, Q.C., Mr. C. Pollock, and Mr. Horace Lloyd for the defendants. The trial of this cause, which has occupied the Court three days, was this day brought to a close.

The plaintiffs were the executors of the late Charles Heard Wild, and they sued the Great Northern Railway Company to recover damages for the infringement of a patent granted to Mr. Wild on the 16th of March, 1853, for "improvements in fishes and fish joints for connecting the rails of railways." The action had been already once tried, when the defendants obtained a verdict, but the Court subsequently granted a new trial upon the ground of surprise. It appeared from Mr. Wild's provisional specification that his invention consisted in forming a recess or groove in one or both sides of each "fish," so as to reduce the quantity of metal at that, and be adapted to receive the square heads of the bolts, which were thus prevented from turning round when the nuts were being screwed on. In his specification subsequently filed on the 19th of September, 1853, Mr. Wild, after minutely describing the invention, stated its advantage to be that—"the groove renders the 'fish' lighter for equal strength, or stronger for an equal weight of metal, than a 'fish' which is made of equal thickness throughout." Having described the nature of his invention, and in what manner the same was to be performed, he claimed,—"1. The constructing 'fishes' for connecting the rails of railways with a groove adapted for receiving the heads of the bolts or rivets employed for securing such fishes, and the application of such fishes for connecting the rails of railways in manner hereinbefore described. 2. The constructing fish-joints for connecting the rails of railways by means of fishes applied to the joints of divided or split rails, in manner hereinbefore described. 3. The constructing fish joints for connecting the rails of railways with fishes, secured by three or more bolts and nuts or rivets, of which the central bolt or bolts, or rivet or rivets, is or are of greater diameter than the extreme ones, as hereinbefore described. 4. The constructing fish-joints for connecting the rails of railways with grooved fishes fitted to the sides of the rails and secured to them by bolts and nuts or rivets, and having projecting wings firmly secured to and resting upon the sleepers or bearers, so as to support the rails by their sides and upper flanges, in manner hereinbefore described." A great many scientific witnesses were called on the part of the plaintiffs to prove the novelty of the invention. They admitted that grooves had been in use for the purpose of preventing the heads of bolts from turning round, but they denied that grooved iron or timber had ever been employed in the manner of a "fish" to unite two pieces of iron or timber. On the part of the defendants, several scientific witnesses were called, who gave contrary testimony, and the model of a bridge, called the Hackney-bridge, on the South Devon Railway, was produced, in which they said a grooved or channelled iron was used as a "fish" to strengthen and support a scarf-joint in the tie-beam. The plaintiff's witnesses denied that the channelled iron in question was so used, and thus the question at issue resolved itself chiefly into an inquiry as to the precise functions performed by the channelled iron in the Hackney-bridge.

The jury found that channelled iron for strengthening, and also for keeping in place bolt heads, was in use before the patent, but that the combination in Mr. Brunel's bridges was accidental, and they did not deem it "fishing."

The Lord Chief Justice said that would be a verdict for the plaintiffs, with leave to the defendants to move to enter the verdict in their favour, should the court above be of opinion that the transfer, as it might be called, to "fishing," and the combination therewith, would not support the patent.

Verdict for the plaintiffs accordingly.

COURT OF QUEEN'S BENCH, DEC. 6.—(*Sittings at Nisi Prius, before Lord Chief Justice Cockburn and a Common Jury.*)

BECKFORD AND ANOTHER *v.* THE ROYAL MAIL STEAM-PACKET COMPANY.

Mr. Serjeant Petersdorff and Mr. Webster appeared for the plaintiffs, and Mr. Wilde and Mr. Murray for the defendants.

This case (involving a question whether Messrs. Miller, of Glasgow, had infringed "Westwood's patent for protecting the iron of ships against corrosion," by using a mixture, before applying asphalte, not distinguishable from what is known commercially and scientifically as "black varnish") was brought to a conclusion this morning. The mixture was applied to two of the company's vessels, and they defended the action under an indemnity from Messrs. Miller.

The jury found their verdict for the plaintiffs—Damages £150.

CROSSLEY'S PATENT JACQUARD MACHINERY FOR WEAVING CARPETS.

COURT OF QUEEN'S BENCH, DEC. 5.—(*Sitting at Nisi Prius before Lord Chief Justice Cockburn and a special Jury.*)

CROSSLEY AND OTHERS, *v* TALBOT.

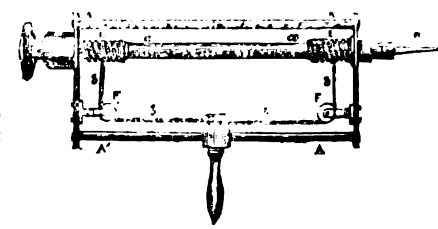
Mr. Atherton, Mr. Grove, Mr. M. Smith and Mr. Webster appeared for the plaintiffs; Mr. Knowles, Mr. Hindmarch, and Mr. Thruff for the defendant. The action resulted in a verdict for the plaintiff (without the case being gone into at length) with the damages (£2000) in the declaration subject to a reference.

PRESS'S IMPROVED QUICK ACTION DRILL STOCK.

Provisionally Registered June 30th, 1859.

THIS improved drill stock will drill holes in metals and other substances with greater ease and rapidity than is attainable by the use of any description of drill stock hitherto made; so, at least, says the inventor of it.

In the drawing *A A, A' A'* is the frame of the



drill stock; *a a* is the spindle carrying the drill *D*. Each end of the spindle *a a* has a spiral external thread, as shown at *E E*. On the frame are fixed two small pullies *F*; a handle *G* is attached to that part of the frame marked *A' A'*, so that it may slide from end to end upon it. To the inner side of the handle is fastened a gut or string marked *b*, which passes over the pulleys, and from thence around the spiral threads, where its ends are fastened. By working the handle *G* from end to end on that part of the frame marked *A' A'*, a very quick motion is imparted to the spindle and drill by means of the gut or string passing over the pulleys and in the grooves or spiral guides, which may be large or small in diameter according to the kind of work for which they may be required.

BLACKBURN'S PATENT TRACTION ENGINE.

THE Smithfield Club Cattle Show and Implement Exhibition of 1858 were open to the public, when we promised to publish a description of the patent traction engine of Messrs. Isaac and Robert Blackburn, of Long Eaton; but the Smithfield Show and Exhibition of 1859 have come round before the promise has been fulfilled. The cause of the delay is to be found in the fact that after our announcement was made last year, we learnt that Messrs. Blackburn had under consideration several important improvements upon the engine, and it was not until recently that these improvements were perfected. We are now enabled to lay before our readers careful engravings of the finished engine in its most improved form, and we hope shortly to give a detailed account of its operation on the road and in the field.

Fig. 1 of the accompanying engravings is a side elevation, and Fig. 2 is a plan of a locomotive or traction engine constructed according to Messrs. Blackburn's invention. *A A* is the large travelling drum, which is connected to trunnions *A' A'*,

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BLACKBURN'S PATENT TRACTION ENGINE.

FIG. 1.

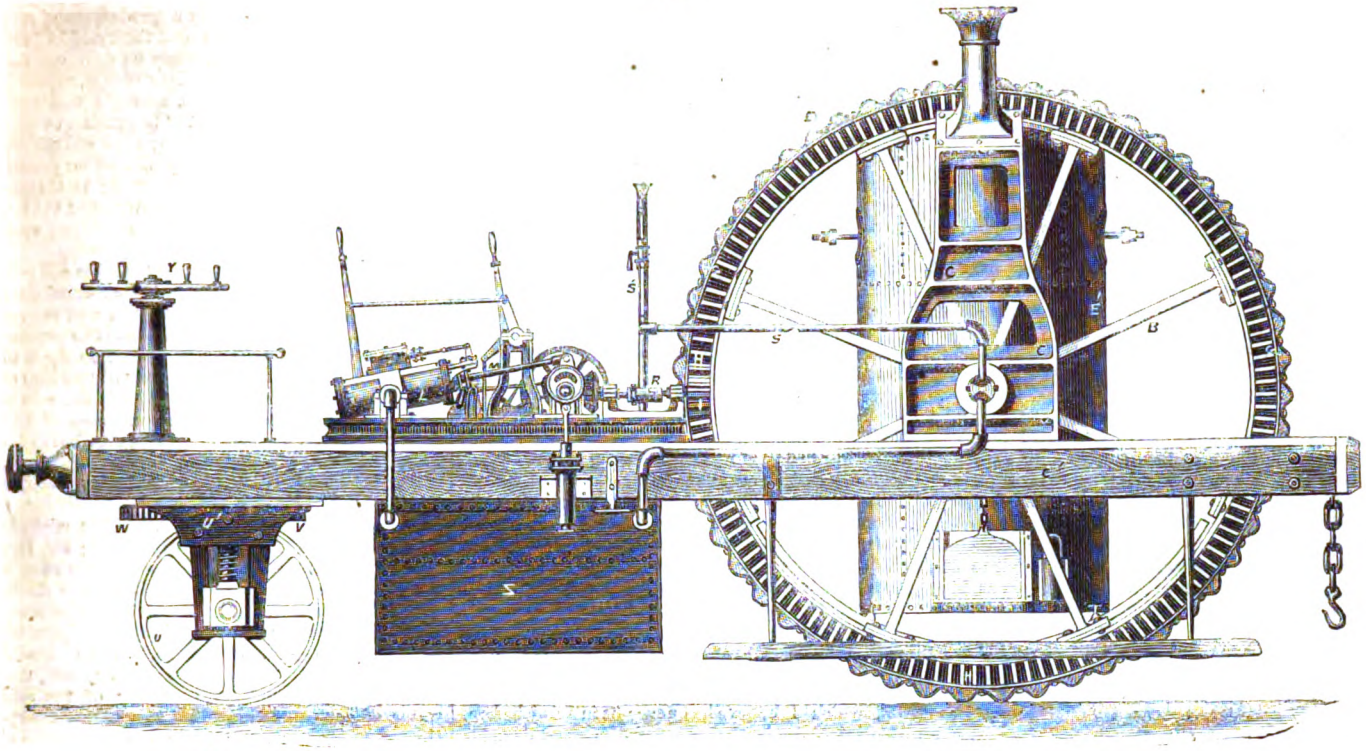
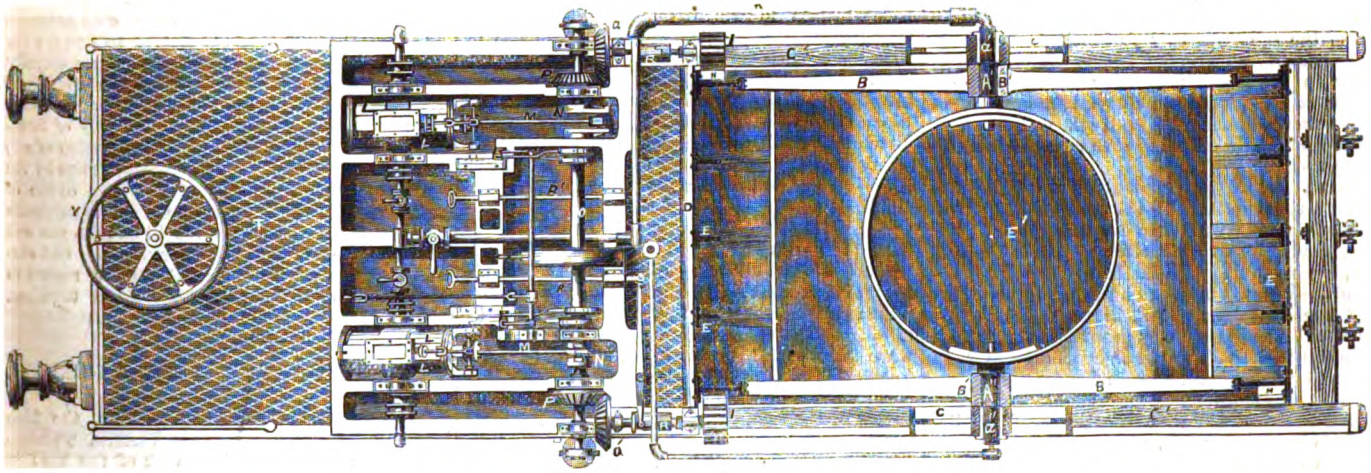


FIG. 2.



by means of arms or spokes *B B* meeting in central bosses *B' B"* through which the trunnions *A' A"* pass. The extremities *a' a"* of the trunnions pass through and support the frames *C C*, to which are firmly secured the longitudinal beams *C' C'* on which the engine rests. The beams *C' C'* are strengthened with iron plates, and the drum *A* is strengthened by the T rings *E E*, which pass entirely round it. The boiler *E'* is supported by the inner ends of the trunnions, as shown in Fig. 2. The surface of the drum is composed of corrugated metal plates *D D*, the spaces formed by the corrugations being filled in by timber, *G G*, in order to strengthen the metal corrugations, and prevent them from collapsing; *H H* are bevil-toothed wheels bolted on the exterior iron ring of the drum, into which toothed wheels bevel pinions *I I* gear, which cause the drum to revolve, as will be hereafter described. *E'* is a boiler which is supported upon the trunnions *A' A"* in the middle of the frame; *K* is a pipe by which steam is let through the trunions *A'* to the cylinders *L L* of the engines; *M M* are the piston-rods, which are jointed to the cranks *N N* that drive the main shaft *O*, which carries at its ends bevil wheels *P P*, that gear into the bevil wheels *Q Q'*, which communicate rotary motion to the bevil pinions *I I*, which gear into the toothed wheel attached to the travelling drum, and so cause it to revolve; *R R* are clutches provided with hand levers *R' R'* for throwing the pinious *I I* in and out of gear, in order that the engine may be employed for other purposes than driving the drum; *S* is a pipe leading to a guage *S'* for indicating the height of the water in the boiler *E'*; *T* is a foot plate or platform, which is supported by the main frame *C'* and the guide wheel *U*. In addition to this guide wheel they use a roller or cylinder when travelling over soft land. This guide wheel is connected by a frame *U'* with a vertical shaft that carries a cog-wheel *V* into which a pinion *W* gears. This pinion is attached to a vertical shaft *X*, which carries a hand wheel *Y*, by which the whole machine is guided. The boiler *E'* is supplied with water through the trunnion *A"*, opposite to that which supplies the cylinders with steam; *Z* is a water-tank which receives the steam from the exhaust, and contains a supply of water for the boiler; *Z'* is a coupling chain for connecting implements of culture or other apparatuses to the engine.

As an implement of culture the patentees employ a cylinder fitted with scarifying or digging tines, which cylinder is fitted to the afterpart of the engine, and is caused to revolve by teeth formed on or attached to its sides, into which teeth pinions gear, receiving motion from the travelling drum of the engine. The depth at which the tines work in the ground can be regulated at will, and arrangements are provided for raising the cylinder wholly out of the ground.

The submarine telegraph between Victoria and Tasmania has been successfully submerged, and Hobart Town is now in direct telegraphic communication with the other colonies.

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ON HEAT.

EXPERIMENTS AND OBSERVATIONS TENDING TO PROVE THAT THE HEAT WHICH DR. BLACK DISCOVERED TO BE ABSORBED DURING THE LIQUEFACTION OF ICE, AND WHICH HE CALLED LATENT HEAT, IS NEVER GIVEN OUT AGAIN ON THE FREEZING OF WATER, WITH REMARKS ON A PECULIAR PROPERTY WHICH SEEMS TO BE DEVELOPED IN WATER AND MANY OTHER FORMS OF MATTER ON CHANGE OF STATE.

By HORATIO PRATER, Esq.

I HAVE repeated the experiment three times of mixing two parts by measure of snow and one part of water at 172° F., and I never found the thermometer fell lower than 36° (even when I diminished this water to ¼ a part), and before it fell thus low twelve minutes had elapsed, and the snow was then only just melted. The almost sudden fall to 32° F. which some experimentalists speak of to prove a loss of 140° in this experiment, doubtless arises from the difficulty there is* to prevent the *actual contact* of snow or ice with the bulb of the thermometer. To prevent this I tied two folds of fine linen round it; and even then we must remember that a stream of very cold water will be apt sooner or later to flow directly on it, since the snow is constantly moving in the water. However, in my experiments the *whole bulk* of the water certainly (sooner or later, according to the temperature of the room) fell to 36°, and as the temperature of the room was as high as 58°, this may probably be the reason—allowing for difference in thermometers, and adding, perhaps, the fact that I used snow and not ice—why it never fell to 32°, as in Dr. Black's experiments. He took equal *weights* of water and ice, but as I found snow thaws into between ⅓ths and ¼ths its bulk of water, I took an overweight of snow. I found the *very* sudden fall to be to about 44°; in *seven minutes* more it stood at 38°, at which time the snow was not quite melted; and in *ten minutes* more at 36°, when the snow was *only just* melted. The long time (viz., on an average twenty minutes) that snow in the above proportion took to melt in water at 172°, is worthy of remark, and proves Thomson's statement (*On Heat*, p. 163), that "snow instantly melts" in such circumstances, to be erroneous.*

When I mixed equal *bulks* of water at 32° and at 172°, the point to which the thermometer came suddenly was 110°; it then continued to sink, but very gradually, for even after 45 min. it stood at 70°, the room being 58° as in the former experiments. When I took *two* bulks of this ice water and *one* of water at 172°, in three minutes it stood at 78°, and then very gradually (viz., in four minutes) fell to 76°, and in eight minutes more to 70°, and there remained, as in the former experiment, a long time.

These experiments sufficiently confirm Dr. Black's great discovery, viz., that an equal proportion of *ice*, or *snow*, mixed with water at 172° makes the thermometer fall far lower than when mixed with *water* at 32°. That in my experiments it never fell below 36° is a difference too light to merit attention.

I found that snow water at 32° took 57 minutes to gain 12° of heat, and still continued to rise very slowly, the temperature of the air being 48°.

In 34 minutes it rose from 32° to 36°, in 23 minutes more (total 57 minutes) to 44°, and did not rise to 46° for nearly two hours.

The very slow rise of the thermometer depended on the external air being only 48°, but the same quantity of snow would doubtless have taken very far longer to melt and rise at the same point; though at the same temperature I observed that a piece of snow of about the size of a *small* cherry took only thirty minutes to melt. Larger masses of snow (if round) take far longer, because the *heat of the external air* cannot come in contact with the centre portions.

In confirmation of Black's theory of the great degree of heat absorbed by the liquifaction of ice, I may also state that when I mixed *intimately* two tea-spoonfuls of snow with one ditto of muriate of soda, the temperature very soon sunk to 4°, (an experiment well known—Thomson, p. 169, says it sinks to 5°.) But in 45 minutes it rose again to 38°. Although in this experiment nearly ⅓rd of the mass remains solid as muriate of soda, yet enough liquid is produced *rapidly* in order to produce cold of 4° below zero, and hence Thomson (op. cit. p. 172) says, "snow and chloride of calcium which liquify immediately on mixture, produce a much greater cold (viz., from + 32° to − 50°,) than snow and salt, which liquify very slowly." "Very slowly," perhaps, when taken and *compared* with chloride of calcium, but taken by themselves I thought they liquified quickly. While I admit, therefore, that Thomson's explanation is right as regards *the main point* (viz., rapidity of liquifaction), I am inclined to think that other causes also assist in causing *so vast* an increase of cold in one of these cases beyond the other.*

That sudden liquefaction is the main cause is, however, shown by mixing a teaspoonful of snow *water* at 32° and one of salt, when I found the thermometer remained *without falling at all*, and was not long in rising even to 36°; the temperature of the air in these experiments being, as above, 48°—a point to be attended to, says Thomson (note p. 168). I am inclined to draw the following inference (in addition to Black's inference) from this experiment with snow *water* at 32°, which I believe has never been tried before. This inference is, that *some* of the effect depends not only on rapid liquefaction (strictly so called), but also on the sudden production of a *nisus*, or power of resistance, from the, so to call it, unnatural state in which snow is thrown when mixed with salt or chloride of calcium, and also in the former experiments when mixed with water at 172°. Even Thomson himself has unconsciously introduced a *physiological cause*, in addition to Black's mere *mechanical* theory of 140°, into this discussion, when he is obliged to admit RAPIDITY OF ACTION counts for so much; for it makes one 140° more than another 140° when the action is quicker.

Again, is not the production of cold in this case (though in others of heat) *in overcoming* THE COHESION of ice entirely overlooked in Black's theory? Is not this cold produced on the spot—"then and there"—by this struggle of ice to *retain unmolested its state of ice?* Accordingly when *water* at 32° is substituted, we find (strange to say) that no *cold whatever* is produced—clear proof that at least, in the case of salt, Thomson's theory of the *solid* water of crystallisation absorbing 140° in order to become water (and thus causing cold) does not hold. He gives (p. 172) this as the theory for the production of a cold of 49·5° (viz., from 54·5° to 5°) when 500 grains sulphuric acid are mixed with 333 grains water, the mixture allowed to cool, and then 10·40 grains of *crystallised* sulphate soda *finely powdered* put in. Again, says he, "Chloride of calcium in crystals contains more than half its weight of solid water," in reference to the cold of 82° produced when this salt is mixed with snow.

Now, in reference to these experiments of Bischof and Walker, who assert the cold is not produced except the salts contain their water of crystallisation, we are hence clearly obliged to admit that this is concerned in the effect; but that it does not act *solely* in the mechanical way supposed by Thomson is proved, I think, by the cold produced in many of these cases *being far greater than is necessary to form ice.* In many of these cases there is clearly a production of cold far beyond what this latent heat theory of 140° can account for, and that, too, when no snow or ice at all is used; for when phosphate of soda, nitrate of ammonia, and diluted nitric acid are used (proportions, 9, 6, 4) a cold of 71° is produced within a few degrees of that produced by snow and muriate of lime. Now, here is cold produced far greater that when water gives out, according to the prevailing theory, its 140° and becomes snow and ice, and that, too, without any assistance from snow or ice!

A point worthy of remark is that the cold produced is *very transient.* Thus, in* my experiment with snow and salt, I think it may be said to have *lasted only while* liquefaction and the *peculiar* motion accompanying this was going on, for in 45 minutes the thermometer rose actually as high as 48°. The secret of the production of cold, even in this case far beyond what the absorption of 140° can account for, is, I believe, to be ascribed to the NATURAL *action of liquefaction being interfered with*, and to its being MUCH HURRIED by the addition of the salt.*

In the great proportion of frigorific mixtures two crystallised soluble salts are used; but that chemical affinity is little concerned in the effect is shown by the solution of one salt only in simple water producing much cold. Thus, for instance, nitrate of ammonia and water lowers temperature from + 50° to + 4°. (Thomson, p. 168.) Now, I infer from this fact, and others above quoted, that the supposed conversion to water of the *solid* water of crystallisation and the *necessary* absorption of 140°, does not explain the production of this *very great* degree of cold, and consequently I infer that this is produced by the RAPID SEPARATION of the atoms of matter by solution. In this way heat is *absorbed*, and consequently cold produced by the *nisus* of the atoms of matter to REGAIN the quantity of heat by which they are naturally surrounded or with which they are combined. That this is the true theory seems to me to follow from reflectiug that the COMPRESSING *of homogeneous atoms together* (as in the compression of air) produces heat; as also of *heterogeneous* atoms by the action of chemical affinity; thus when oxyde of zinc, &c., is formed by the action of dilute sulphuric acid, or when iron wire burns in oxygen gas and produces the oxyde. Thus, compression and chemical affinity act in the same way in regard to their tendency to force the atoms closer together.

(To be continued).

* Professor Thomson often speaks of the slowness with which ice melts, and attributes it to the necessity for absorbing 140°, but I believe the real cause to be (and this cause applies equally to the slow melting of snow in water at 172°) that heat has not merely to be absorbed, but the COHESION of the ice or snow has also to be overcome, for we know that ice can't remain ice, and absorb heat above 32°. If it could, these 140° could be absorbed as quickly in this case as in many others.

* The reason why the thermometer falls to − 4° or − 5° in this experiment, and when ice is simply melting remains at 32°, is no doubt to be ascribed to an excess of cold produced *above* the 140° which Black rightly inferred do not affect the thermometer, because they *combine* with the water formed. But in the snow and salt experiment not only are the 140° absorbed, *but as they also must be insensible to the thermometer*, the fall to — 5° must be caused by an *extra portion* of heat to that extent absorbed from surrounding bodies, which not being able also to *combine* with the water and salt, thus becomes sensible to the thermometer.

* While I assert this, I by no means wish to deny that this "hurried action" does not act mechanically by causing such a *sudden* loss of heat that air, &c. (though at 32° or more) cannot restore it with *sufficient rapidity* to prevent a great fall in the thermometer. Thus, says Thomson, "Mercury may be frozen even in a *warm* room" by snow and chloride of calcium, and water may be frozen in a red-hot crucible, as Boutigny has shown, by anhydrous sulphurous acid.—(*Etudes*, &c., &c., 3ieme. edition, 1857.) It is clear that these and other marvellous facts stated in the volume just quoted, depend more or less on the fact that heat, *left to itself undisturbed*, moves much less quickly than electricity, and always requires *a certain amount of time* to establish its equilibrium. The *long time* the thermometer often takes to rise or fall shows the truth of this statement; but it is not easy to believe this at first, as we are generally accustomed to observe heat when *circumstances oblige it* to move very quickly.

I may here add that another grand distinction between heat and electricity is, that the former seems to be able to move through ALL kinds of matter, though through some with difficulty, including even ice (a non-conductor of electricity), as Tyndall's late experiments show, also Melloni's (see his tables, Ann-de Chim et Phys., Tom. 55).

OPENING OF THE VICTORIA-BRIDGE, CANADA.

ALL Canada was rejoicing on Thursday, the 24th of November last, as the great Victoria Tubular-bridge, the most stupendous work of the kind in the world, and the connecting link between two important sections of the Grand Trunk Railway, was being opened on that day. The first train consisted of an engine and single car, containing about 50 persons. The time occupied in passing

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was about 12 minutes and a-half. Among the gentlemen in the car were the Hon. Mr. Cartier, Premier; Mr. M. Ross, chief engineer of the bridge; Mr. Blackwell, managing director, and several directors of the Grand Trunk road. Two of the tubes are not quite finished, but the bridge is expected to be fully completed and thrown open to traffic about the 15th inst. This will be exceedingly opportune for the trade of Canada, which is expected to derive a renewed impulse, as the water navigation has ceased. The traffic over the line is steadily increasing. The receipts for the week preceding the opening to Detroit, which took place on the 21st ult., amounted to 60,560 dols., being 10,000 above the receipts of the corresponding period of last year. The prospects of through Western freight are very good.

LIGHT WOODS AND UNSINKABLE SHIPS.

THE following letter from Captain J. H. Selwyn, R.N., is accompanied by a specimen of extremely light wood. It is in the form of a short cylinder, 3¾ ins. in diameter, of a mean thickness of 1⅛ ins., and weighs 323 grains. It would no doubt absorb a considerable weight of water, (as Captain Selywn suggests,) but as we purpose sending the specimen to the Society of Arts we will not venture to test its absorbent qualities:—

GENTLEMEN,—I send you a specimen of light wood, which may afterwards, if you please, go to the Society of Arts. It is probably the same as that sent by Mr. Cunningham. I brought it from Brazil; it is the stem of the great flowering South American aloe, not a cactus. I do not think any of the cacti have any such wood. But light woods approaching this specific gravity, but of large size, are well known both in America and Africa, and are in America used for making Balsas or navigable rafts, while in Africa they are principally used for floating the heavier woods down the rivers. I do not, however, think that any such means can ever be useful for making unsinkable ships, for the space occupied must always be so comparatively great as to exclude any useful cargo, and all such bodies have the fault of rapidly absorbing water, and then of course losing their floatative qualities until again dried. Balsas or catamarans are always hauled up on the beach to dry after their short voyages. I think that more than anything else *speed* and bottom, *i.e.*, economy of fuel, will decide the future naval engagements, at least as regards the material, and invulnerability or unsinkability are alike opposed to both of these, the one by increasing the weight, the other by decreasing the space available for fuel. J. H. SELWYN.

UNSINKABLE SHIPS.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Woolwich Dockyard, Dec. 6th, 1859.

GENTLEMEN,—I am glad to observe that the suggested idea "unsinkable ships" is attracting the attention of your readers, whose remarks hold out the expectation that the subject will be thoroughly discussed. I am, however, not disposed to notice much of the banter with which it seems that the suggestion of original views on matters connected with practical science must be expected to be publicly received. In starting the idea of constructing ships so as to be unsinkable, I made no profession of having matured the details of such a project, for, first of all, the materials most advantageous for the purpose had to be determined, also the practical mode of applying them, which would greatly depend on the nature of the materials themselves; and ultimately the extent and varieties of application to which the principle can be beneficially adapted depends on considerations which, perhaps, no one individual is competent fully to appreciate; and all these contingencies are mutually dependent on each other. In the case now in question, it was the opening up of the Australian gold-fields that originated in my mind the idea of "unsinkable treasure ships," for which purpose a mass of material built together solid, or if not suitable for being built together, filling up the compartments of a cellular construction so as to form a solid floating mass up to or a little above the load line of the vessel—such mass as respects its form and stability being, of course, constructed in accordance with the essential elements of naval architecture—would, I dare say, form a suitable bottom for such purpose. The treasure might be duly secured or embedded therein, and suitable accommodation for the crew would form the superstructure of the hull. Such was the original idea, and incidental circumstances, such as the supposed irresistible force and precision of modern ordnance, and the threatened introduction of the marine ram, gave rise to the suggested application of the system to ships generally. Every case of special application will, of course, demand special adaptation of practical details, the general result being that the aggregate mass of material, when immersed in water, shall not merely float itself, but be capable of supporting, in addition to its own weight, the load that may be imposed on the ship. The distribution of the material for giving the floating power will be a matter of arrangement in which great ingenuity may be displayed, and all the elemental principles of naval architecture will be called into requisition in the construction of "unsinkable ships," as is now the case in the construction of floating vessels generally.—I am, Gentlemen,

Yours very obediently,

CHAS. ATHERTON.

THE LOSS OF THE ROYAL CHARTER.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—The inquiry into the loss of the Royal Charter having been closed, I beg to offer a few remarks, which you may perhaps deem not altogether useless on that unfortunate accident.

It seems extraordinary that no reason is shown by the evidence why the operation of wearing did not succeed. "Wearing" (I may say, for the benefit of your non-nautical readers) consists in the turning of the ship's head *from* the wind in order to gain the opposite tack, as "tacking" or "staying" is the turning of her head towards the wind with a similar object.

The Royal Charter, according to the evidence, had not for some time been able to keep *to* the wind, *i.e.*, within six points, even with the helm hard a starboard. Tacking, therefore, would seem to have been out of the question. It was, however, tried but failed. But wearing ought, one would think, to have succeeded, and why it did not is the mystery, more particularly if the means were adopted to which I shall now refer. Admiral Paris, of the French navy, has recently spoken of some phenomena in the manœuvring of steamers, which, I trust, are not unfamiliar to many of my brother officers. I do not think he notices the one which is applicable to this case. If in a heavy gale, the ship being on the port tack, with but little sail possible to be set (say a foretrysail or staysail), it be desired to wear, the screw, particularly if auxiliary, may be thus applied, bracing the yards, &c., as usual. From going a-head reverse and go astern easy, as quick as you can, the helm to be put very slightly to *starboard*. The ship's head will fall off quickly, because the screw gathers to port before it can act to force the ship astern. As soon as the wind is aft go ahead again. This can, of course, only be done (with a right-handed screw) if on the port tack, as the action is entirely caused by the differing immersion of the two blades, and the consequently differing force exerted by them; you will by this means, if skilfully done, lose but little if any more ground than if you had tacked, which is sometimes impracticable under such circumstances, and always uncertain.

A curious and, I believe, hitherto unaccounted fact connected with paddle steamers is, that if you go astern, they will always turn their sterns towards the wind, as well where the paddles are in the middle as when they are nearest the bow.

J. H. SELWYN.

STEAM-SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Woolwich Dockyard, 7th Dec., 1859.

GENTLEMEN,—It is rather a trial of one's patience to have to repeat explanations in matters of theoretical investigation. But in courtesy to correspondents those who court public investigation in such matters must, it seems, frequently submit to such necessity; there is some satisfaction, however, in the fact that every such repetition in a public journal such as the MECHANICS' MAGAZINE attracts fresh inquiries towards the subject in discussion. With reference, therefore, to Mr. Cheverton's remarks in your last number (No. 49) on the construction and application of the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h. p.}} = C$, I beg to repeat that in the calculation by this formula of the mutual relation of displacement, power, and speed of vessels of different sizes represented by their respective displacements, the coefficient (C) after having been practically ascertained for one vessel of the type under consideration, is assumed to be a constant number only for vessels of that particular type of immersed form, and in which the ratio of gross indicated h. p. to the effective working power is also assumed to be a constant number, or closely approximate thereto; also it is assumed that all other circumstances affecting the performance of the vessels are under similar conditions as usually implied by the term *ceteris paribus*. It is therefore only on the assumption of the co-efficient corresponding to the type that may be under consideration being known or approximately so, that any pretension is made to the mutual relations of displacement, power, and speed being determinable by this formula, that is, for either one of those elements being determinable the other two being given. It is also to be observed that two different types of steam-ship construction may possibly give the same co-efficient, that this can only be regarded as a coincidence in exception to the general rule.

Presuming on these theoretical properties of the formula being confirmed by experience and conceded, it follows that the different co-efficients respectively distinctive of different types of steam-ship construction indicate the order of merit with reference to the mutual relations of displacement, power, and speed, in which the dynamic performance of vessels of different types may be rated or classified, and if instead of the indicated h. p. as the denominator in the formula, we adopt as its representative the consumption of coals per hour (W), the comparative co-efficient resulting from this formula will in like manner indicate the order of merit with reference to the dynamic duty capable of being performed by the respective ships thus tested in comparison with each other.

I am, Gentlemen, your very obedient servant,

CHAS. ATHERTON.

METEOROLOGICAL TELEGRAPHY.

A TALENTED author in one of his works on nautical science intimates that the electric telegraph might be advantageously used for the purpose of conveying notice of approaching storms. This novel application of meteorological science may be appropriately termed "meteorological telegraphy," and I ventured to suggest to the Aberdeen Session of the "British Association for Advancement of Science" that they should appoint a special committee to consider and report upon some uniform plan for ascertaining the nature, force, and direction of sudden weather changes, and flashing warning telegrams, in such effective manner as to result in the saving of many lives and much property annually, especially by prevention of wrecks in our channels, and on the coasts. The proposition was submitted to the committee of the section of mathematical and physical science, and upon their favourable report the general committee of the Association passed a resolution recommending "application to the Board of Trade for such an arrangement as may further this object authoritatively." Illustrations and arguments in support

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of such a system would be tedious and unnecessary in the columns of a newspaper. It may suffice to state, that the chief means of attaining the desired purpose would be the establishment of barometrical stations in salient or extreme positions on our coasts, coterminous with the respective points of the compass, whence prevalent storm-winds blow, and thence telegraphing warning communications to distant shores or seaports. We possess the knowledge and instrumentality, and the practical adaptation of the latter would be both easy and inexpensive.

This subject, with its associate themes, is fraught with numerous considerations of incalculable importance for all maritime States, more especially for the British Islands, whose watery highways are quick with human life, and crowded with laden ships, ever intercrossing day and night, in light or darkness, storm or fog. The perils of sea-transit far exceed those of land, and yet how much more carefully are the latter guarded against by preventive arrangements! Why should not all our frequented channel tracts, and even great ocean routes to (say) forty miles distance from the principal ports, be indicated at certain intervals by conspicuous buoys, or even by anchored vessels, displaying characteristic symbols of position and contiguity to coast or haven. Apart from the inestimable value of human life, the cost would probably not amount to a moiety of the value of property destroyed by wreck within a period of five years; and as for the asserted impracticability of mooring ships securely in blue water, the genius of invention would soon overcome that difficulty. Once the benefit of an object confessed, and fitness of the means of attainment duly estimated, the true born son of science instantly sets to work to accomplish it, without even a doubt. Imagination conceives the project, science brings forth the completed labour, and THEN the halting advocate of mere practice and precedent wonders and admires; and it may be, in happy forgetfulness of his former incredulous prejudices, congratulates himself, as if he also were a co-worker in the progressive achievements of inventive science.

An extended publicity is respectfully solicited for these brief remarks, with the hope of attracting thoughtful and benevolent minds to a speedier solution of the important question submitted—namely, the prevention of loss of life, time, and property by storms, especially in the channels, and on the shores of the British Islands.

JOHN LOCKE.

Rathmines, Dublin, Nov. 1859.

LIGHTING MINES.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I see that a paper is to be read this week before the Society of Arts, on the subject of accidents in coal mines. Now, as one of the greatest causes of accidents is the explosion of fire-damp, in which, by the carelessness of one individual, the lives of hundreds may be sacrificed, I venture to suggest that for the purpose of illumination, the electric light should be employed. Electric lamps might be hermetically sealed up in glass globes, and stationed in the various branches of the workings, and by means of suitable reflectors the light might be carried into almost any direction. If desirable the lamps might be made to some extent moveable, being fixed on a pedestal, and connected with the battery by insulated conductors; and if suspended aloft they might be made to illumine a large area at once. I know that economists would object that the arrangement would involve considerable expense, but the attainment of perfect safety would more than repay the extra expense (if it existed), while the miner who felt himself free from danger and under the influence of a genial light, would both be happier in mind, more comfortable in body, and would do double the work which he did before, while groping under the dim rays of his present safety lamp.

I have the honour to remain, Gentlemen,
Your most obedient servant,

F. MAXWELL-LYTE.

Bagneres de Bigorre, 28th Nov., 1859.

RAILWAY SIGNALS AND WAR APPLIANCES.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—I made the following practical demonstrations of my appliances for war and home defence this day at Beaufort-house, Walham-green, in presence of Lord Ranelagh, his corps of volunteer rifles, and a numerous party of ladies and gentlemen amateurs.

No. 1 in the catalogue—A railway guard and passenger explosive signal to slide down a tube in a railway carriage on the iron rail, by which it explodes by percussion with a report much louder than a fog-signal such as is now in use.

No. 2—A grenade fired by friction, at about seven feet from the ground, by the check of a cord reaching to that height from an upper window. This grenade was thrown out of an upper window of Beaufort-house by a young gentleman of about the age of 15. It can be used in perfect safety by ladies in defence of "home, sweet home," thus "placing the weak on a par with the strong."

No. 3—Rifle fire-shot or spinster. This missile is far more efficient than the rifle percussion-shell for blowing up ammunition waggons.

No. 4—A safe way of fixing percussion appliances in the mouth of elongated rifle-shells for rifled cannon. This is done by inserting the appliance about a quarter of an inch below the mouth of the shell. The ramrod cannot then press on it, and if the shell should fall from the hands on the ground or the deck of a man-of-war percussion-end foremost, it is still safe; but by striking an object with great force when discharged from a rifled gun, it cuts out its own plug, which explodes it. Lord Ranelagh fired two elongated wooden shells from a large rifle into a heap of loose sand, where they instantly exploded, proving that iron shells on a similar construction can be employed from rifled cannon to destroy clay defences, on which mere shot have little effect.

No. 5—Gossamer cartridges. Lord Ranelagh fired several of these from a dragoon's pistol of the Enfield bore, and similarly rifled, showing how rapidly and efficiently they can be used in loading. They do not require to be broken or opened previous to insertion, as the military cap fires them to a certainty, provided the upper part of the nipple is countersunk so as to take in the whole fire of the cap. The cartridges were charged with Curtis and Harvey's improved coarse-grain gunpowder, No. 3.

I am, Gentlemen, yours, &c.

J. NORTON.

Rosherville, Dec. 3.

DEATH OF MR. JOHN FINCHAM.

THE death of this gentleman took place at his residence at Highland-lodge, Landport, near Portsmouth, on Tuesday morning, in his 75th year. The deceased will be best remembered by the general public as for many years master shipwright of Portsmouth Dockyard, and more especially as the builder of the Arrogant, the first screw frigate possessed by this country. Much of his time and study was devoted to the introduction of the screw propeller into the British navy. For a long period he was shipbuilding superintendent of the School of Naval Architecture at Portsmouth, and in later years had nominal charge of the practical part of the studies at the School of Mathematics and Naval Construction. His *History of Naval Architecture, Outlines of Shipbuilding*, a *Treatise on Laying-off Ships*, and on *Masting Ships*, are well known among professional men. As an acknowledgment of their merits the Emperor Nicholas, of Russia, presented Mr. Fincham with a snuff-box set with diamonds, and Mehemet Ali presented him with the order of the "Bey." Mr. Fincham was greatly indebted to others for assistance in the preparation of these volumes, and in the construction of the ships which were designed by him. His connection with the late School of Naval Construction resulted unhappily—the members of it attributing to him the chief cause of their undue depreciation. Mr. Fincham long since, we regret to say, lost nearly all physical and mental energy, and his decease has for some time been apprehended by his relatives. He leaves behind him a son to succeed him in his profession—Mr. John Fincham, first assistant master shipwright of Chatham Dockyard, who will without doubt attain ere long the post of master shipwright in the service—the highest to which his father rose. It is only due to the late Mr. Fincham to say that for many years he received successive proofs of the high esteem in which the Admiralty held him.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements. To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

Our Weekly Gossip.

DURING the recent trials at Shoeburyness of the 12-pounder Armstrong guns intended for China another of the breech pieces was blown from the gun and fell about two hundred yards in the rear of the battery. This shows the extreme necessity for the utmost caution in the manufacture and use of guns upon this principle; and it becomes a grave question whether in the heat of action occurrences of a similar description may not readily take place, and thereby render the gun *horse de combat*, with the probable sacrifice of many valuable lives.

Inquests, Board of Trade inquiries, Committees of Investigation, and other like machinery, are of exceedingly little use to us in this country. The explosion of the Great Eastern ended in a wrangle before a country jury, who read newspapers while directors and contractors lied (some of them) and quarrelled. The loss of the Royal Charter has had a result less disgraceful but equally useless. Mr. Mausfield, the magistrate at Liverpool, and Captain Harris, the nautical assessor, have inquired into the latter melancholy event, and their report to the Board of Trade is before us. They tell us that a portion of the iron of which the Royal Charter was built, recovered with great difficulty and expense from the wreck, has been produced before, and tested by, the Liverpool corporation machine. "It is decidedly above the average strength of iron plating used for shipbuilding, and the average strength assigned by Mr. Fairbairn for good Staffordshire plate." Again we read, "from the evidence, I have arrived at the conclusion that the Royal Charter was, at the least, fully equal in strength to the average of ships of her class built at the same date (1855). Whether this be sufficient is a question which in reality does not arise in the present inquiry. Even if it did, I should hesitate to generalise from an isolated instance, on very imperfect evidence, and where so much is left to conjecture. A much wider induction is necessarily applied to the subject by underwriters in the ordinary course of their business; and to those of the public who may be ignorant of the fact it may be of interest to learn that, *ceteris paribus*, there is no difference in the premium paid for insuring wooden or iron vessels of the same class." Mr. Mansfield and Captain Harris also think that the ship was not properly prepared (by making her snug aloft) for encountering the rising gales—that (as we pointed out weeks ago) the Captain should have either run into Holyhead or kept the open Channel behind him—and that her masts were not cut away soon enough. They likewise point out the danger of steaming ahead while at anchor in a gale. A gale of wind is not uniform in strength, there are moments of comparative lull. During these the steam power not being readily controlled is apt to shoot the ship ahead. After this, when a violent gust occurs, the ship drops astern, bringing up with a sudden and a severe jerk on her cables—a kind of strain most likely to make them part. The cables of the Royal Charter were full 2¼ ins. in diameter, and were tested by the maker, Mr. Woods, of Chester, to 72 tons. It is reasonable to suppose that the material and workmanship were

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good. We need hardly say how little is to be found in all this to satisfy the public mind. If we are to draw inferences from this report, they can only be, that the Royal Charter was a very good iron ship, and that any other such ship would have gone to ruin as speedily and utterly as she did, after once coming upon the rocks. Comforting assurance!

The action which Messrs. Mears commenced against Mr. Denison for his statements respecting the bell, Big Ben, cast by them, was entered for trial for the sittings after Michaelmas Term in London, and would have been tried by Lord Chief Justice Cockburn and a special jury. Mr. Denison pleaded a justification to the libel with which he was charged. The case was, however, withdrawn on Wednesday last, Mr. Denison having abandoned his defence. The plaintiff will therefore take a judgment by default. The only matter remaining to be determined is the amount of damages, which, in the usual course, will have to be assessed in the Sheriffs' Court.

Mr. Walesby sends the following practical suggestion:—

GENTLEMEN:—On Saturday last I heard Big Ben perform for the first time since it had been reported that he had been fatally wounded; and I have to state that, cracked or not cracked, his voice is neither worse nor better than it was in the very first instance when the clock struck him to indicate the hour. In other words, the bell merely emits the same imperfect sound as before, being remarkable for metallic harshness and doleful continuity of tone. Now, although I think this bell, like its predecessor, was designed and cast too thick at the sound bow ever to produce a rich and mellow tone, even supposing no deep crack to exist, yet as the bell is suspended in a manner so objectionable that it has not fair play, the authorities may be advised to try the following experiments:—Release poor Ben from his present unhappy position, of which he has always bitterly complained; then fix him to a block of "wood" of suitable form called a stock, which must be freely suspended from a beam so as to be able to swing in some degree. If the alleged fracture be not dangerous, Big Ben the second will then give out such a sound as may agreeably surprise his audience. Permit me to add that when a large bell is cracked at the sound bow, it is idle to talk of applying the "drill-a-hole and whip-saw remedy." This has been tried over and over again in the case of Church bells—though not at present in that of Big Ben—and the result has uniformly been most unsatisfactory to a musical ear. I am, &c.,

THOMAS WALESBY.

December 5, 1859.

Mr E. Edwards, glass-manufacturer, of Birmingham, states that glass, when cooled too quickly, is rent into fragments which are invariably found to be wedgelike, or following the general shape of the arrow or spear heads recently found deep down in pre-Adamite geological beds. Hence he starts a theory:—He supposes that in the early geologic periods masses of flint or large boulders may have become heated by subterranean fires, and while in an incandescent state have been suddenly thrown by volcanic force to a cool place; the outside of the mass would soon begin to contract, while the inside would retain its heat and its expanded condition; the struggle between the two forces would go on until the mass was rent to fragments, and each of these fragments would be one of the "works of art" of which we have lately heard so much.

The following regulations for the admission of the public have been arranged by the Committee of Council on Education and the Trustees of the National Gallery. 1. The separate entrance to the National Gallery, British School, provided at the request of the trustees of the National Gallery, will be open for the public on Mondays, Tuesdays, and Saturdays, and for students on Wednesdays, Thursdays, and Fridays, in the daytime only. 2. The public will be admitted to the National Gallery, British School, also through the Museum every day, and on those nights when the Museum is open, according to the regulations of the Museum. On those nights the National Gallery, British School, will be lighted by the department. 3. Wednesday being a public day at the National Gallery, and a students' day at the South Kensington Museum, will hereafter be a students' day at the National Gallery, British School, and the public admitted on payment of (6d.) to the South Kensington Museum will be admitted also to the National Gallery, British School, through the Museum only, the National Gallery students being admissible by the separate entrance. 4. On Wednesdays, Thursdays, and Fridays, when only Students are admitted to the National Gallery, British School, the public admitted by payment (6d.) to the South Kensington Museum will be admitted to the National Gallery, British School, through the Museum only. 5. The National Gallery, British School, will be opened on Monday, 5th December.

Will some of our readers respond, if possible, to the following inquiry?

Abercarn, December 5th, 1859.

GENTLEMEN,—Can you kindly help me to obtain any information on the following subjects:—I possess the *first three* vols. of Holtzapffels Turning and Mechanical Manipulation, which of themselves, so far as they go, form an admirable work; but unfortunately there seems no prospect of the work being ever completed. Can any of your readers inform me of the titles and price of any modern works which would supply the deficiency, more particularly as to *plain turning* with and without the slide rest, &c.? *ornamental* turning I do not so much care about. If you obtain for me the required information you will much oblige an old subscriber. W. R.

Captain John Norton, of Rosherville, writes:—

GENTLEMEN,—Having good and sufficient reason to believe that the authorities are now anxious to know who was the first to suggest, and practically to demonstrate the superior advantages of an elongated expanded shot, I beg to say it was devised immediately by myself from the expanding lotus pith base of the Malay tube-dart, which I submitted and fully explained to the select committee of artillery officers, at Woolwich, as far back as the summer of 1823. The officers now living that can bear testimony to the fact are, General Sir Robert Gardiner, R.A.; General Sir Richard Airey, now Quarter Master-General, Colonel Barlow, Chairman of the Southampton Dock company, Major Hector Straith, late Professor of Fortification at Addiscombe Military Seminary, Captains Thomson and Hadison, the last five of whom were present with my late regiment, the 34th, at the time. Colonel Beamish, in his memorable letter of August, 1852, to the editor of the *United Service Journal*, at page 3, gives a full and clear narration of the facts. I have left a specimen of this shot at the United Service Institution, Whitehall. Colonel Wilford, in his recent lecture at the United Service Institution, has truly stated that the great improvement in rifle efficiency is to be traced to the elongated form of the shot. I am, yours, &c.,

J. NORTON.

Rosherville, 5th December.

A gentleman who has himself invented guns, and taken them before select committee after select committee, sends the following:—

GENTLEMEN,—It is a well known fact in every official branch of the public surface, the Armstrong gun is only Armstrong in *name*, and that it would not have found its way in that name, had not the Duke of Newcastle been appointed to the war department just at the moment the originality of the invention was about to be better known.

All men interested in inventions made for the public service quite agree with your remarks, gentlemen, "*That the war office has not the right to spend the money of the nation*" to serve the special purpose of any protegé of men in power; be it his Grace the Duke of Newcastle or the Right Honourable Member for Morpeth, Sir George Grey, who who may become the patron of the inventor. Captain Blakely's challenge of £500 will not be taken up by the fortunate maker of the so-called Armstrong gun "or any of his champions," however important it may be to *all taxpayers*, as you justly remark. They can better afford to give Captain Blakely £500 to say no more about the gun or its maker, lest it should lead to an open investigation as to who really invented the gun, and first brought it under the notice of the select committee at Woolwich. For the sake of the taxpayer and the efficiency of the service, Captain Blakely will serve Her Majesty best by calling the attention of the Executive through the Legislature, not only to the Armstrong gun, but other guns and mortars so strongly patronized by the Government since 1854, when his Grace of Newcastle, in his zeal for improvement, gave the start at Woolwich which has been so *economically* carried out. Let him show a disposition to do this, and no doubt the £500 will increase; and with it, a far better chance of his money being returned to him than by seeking justice from the Secretary of State for War, or challenging competition with the extraordinarily lucky maker of the Armstrong gun. OBSERVER.

LIST OF NEW BOOKS.

Douglas on Modern Systems of Fortification, 12s.
Engineers', Architects', and Contractors' Pocket-book, 1860, 6s.
Potter's Elementary Treatise on Mechanics, 4 edit., 8s. 6d.
Winter's Elementary Geometrical Drawing, Part I., 3s. 6d.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 1065.
BOILERS AND THEIR FURNACES, &c., 1054.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c. *None.*
SHIPS AND BOATS, including their fittings, 1062.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 1072, 1075, 1081.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1085.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1060, 1063, 1070, 1077, 1086, 1010.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c. *None.*
LIGHTING, HEATING, AND VENTILATING, 1052, 1058, 1061, 1066.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1051, 1067, 1074.
METALS, including apparatus for their manufacture, 1076, 1084.
CHEMISTRY AND PHOTOGRAPHY, 1099.
ELECTRICAL APPARATUS, 1069.
WARFARE. *None.*
LETTER PRESS PRINTING, &c, 1079.
MISCELLANEOUS, 1053, 1055, 1056, 1057, 1059, 1069, 1071, 1073, 1078, 1080, 1082, 1083, 1087, 1088.

1051. J. H. JOHNSON. "Improvements in machinery or apparatus for grinding and polishing knives, and other articles of cutlery, and tools." (A communication.) Dated April 26, 1859.

This consists in the use, in combination with a grinding-stone or polishing wheel, of a revolving drum for carrying the articles to be operated upon, each drum being fitted with suitable matrices in which such articles are placed, the said matrices being adapted to give the required shape to the articles to be ground, and enable such articles to be ground and polished in a uniform manner. *Patent completed.*

1052. J. M. CIROUX. "Improvements in lamp-glasses and shades, applicable to gas-burners, light-houses, and railway-signals." Dated April 27, 1859.

This consists in making glasses and shades of crystal rendered convex either externally or internally, or on both sides, for lamps and lanterns, and applicable to certain gas-burners, to lighthouses and railway signals, which convexity is obtained by known means, and by which a greater brightness is given to the light than by the ordinary glass. *Patent abandoned.*

1053. G. PEARSON. "Improvements in apparatus for cutting and shaping trenails." Dated April 27, 1859.

This apparatus consists of a cylinder, or box bored out to suit the shape and size of the trenails. One end of the box is enlarged, forming the conical head, and made with an aperture in the side for admitting the cutting blade, which is adjustable, and fixed with screws to the outside of the cylinder. This cutting blade is so shaped as to cut the cylindrical parts of the trenail as well as the conical head. A second cutting blade is fixed to the face of the tail-end of the box for cutting the ends of the trenails. The head-end of the cylinder has a guide plate screwed to the cylinder flange, while at the tail-end a washer or plate with an enlarged bore, and open at one side to allow of the escape of the shavings, is attached to a similar flange with bolts, by which the cylinder is also firmly fixed to a small chuck, which has an external screw for screwing on to the end of a revolving spindle. The pieces of wood intended for trenails are first cut into lengths equal to the lengths of two trenails, and as they are of an irregular form, they are formed in cylinders slightly tapered at both ends. These cylindrical pieces of wood are introduced through the guide-plate, and pushed in till the end reaches to, and is shaped by, the end blade, the cylinder with its blades revolving rapidly, whilst the piece of wood is held fast. This double trenail, after both ends have been cut, is then cut in two by the circular saw, and the heads faced by a cutter similar to the one for facing the trenail ends. The blade which performs this last operation is fixed in a separate cylinder. *Patent completed.*

1054. J. HYDE. "Certain improvements in steam-boilers." Dated April 27, 1859.

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This applies to those steam-boilers in which one or more internal flues are employed, and consists in suspending a water chamber within the flue or flues; these chambers are connected by tubes to the interior of the boiler to allow the water to circulate freely therein. The end of the water chamber near the bridge divides the products of combustion which, in passing along the flue, surround the water chamber, and distribute the heat. *Patent abandoned.*

1055. H. R. FANSHAWE. "Improved apparatus or mechanism for drawing-off, filtering, and gauging liquids in butts, barrels, casks, and such like vessels, preserving the contents from deterioration from contact with atmospheric air." Dated April 27, 1859.

The patentee claims the use and adaptation of a bag with its adjuncts, which, by the introduction of air pressure, will occupy the void formed as the liquid is drawn off, sufficient pressure being kept up by this means to allow a free draught. Also the gauging and filtering apparatus described. *Patent completed.*

1056. J. and W. STUART. "Improvements in machinery or apparatus for manufacturing nets for fishing, and for other purposes." Dated April 27, 1859.

This invention is more or less based upon a net-making machine for which a patent for Scotland was granted to James Paterson, July 27, 1835. The mechanical arrangement by which the twine or yarn is netted, consists of a combination of needles, hooks, and fullers, the joint operations of which form a series of twisted loops extending across the machine. Through this series of loops a length of twine or yarn is carried by a shuttle, which consists of a long hooked wire or slender rod, which is caused to pass through the loops, and in traversing back to its normal position it draws with it the twine or yarn, which is cut off by a self-acting cutter when the traverse is completed. A corresponding arrangement is fitted on the other side of the machine, so that the two shuttles work alternately to form the series of equidistant knots in the material of which the net is manufactured. The object of the present invention is to modify the original machine before-referred to, so as to render it capable of producing the higher numbers of mesh or finer qualities of net, solely by mechanical means. There are various modifications included. *Patent completed.*

1057. J. R. SMITH. "Improvements in obtaining motive power." Dated April 27, 1859.

Here a wheel with a tubular or hollow run, capable of revolving in a vertical plane upon a horizontal axis, has attached to its periphery at equal distances apart, and all round it, a series of open cages or chambers, each containing a flexible diaphragm of tubular or bag form. The tubular or chamber space in the main wheel is filled with water, mercury, oil, or other liquid, and by means of certain other arrangements (the details of which we cannot give space to) the wheel is made to revolve in either direction. *Patent abandoned.*

1058. R. J. LAING. "Improvements in wet gas-meters." Dated April 27, 1859.

Here the patentee employs a ball or other suitable valve suspended by an arm or other suitable means from above in either or both of the gas passages of the meter, so that when the meter is in a correct position such valves will hang free of the openings they are capable of closing, but so soon as any tilting takes place these openings will be closed, and the passage of the gas stopped. These valves may be arranged in pairs so as to close either way. *Patent completed.*

1059. C. HAMP. "Certain improvements in locks." Dated April 27, 1859.

This relates to lever locks, and consists in constructing them with two distinct sets of levers, each operated upon by the bit or bits of the key; also in forming the keys of lever locks with two bits, each bit being intended to operate each of the aforesaid sets of levers for locking and unlocking the same. It is also proposed in some cases to use a loose curtain attached to the case of the lock. *Patent abandoned.*

1060. J. HOLROYD. "Improvements in machinery used for finishing woollen and other cloths." Dated April 27, 1859.

This consists in so constructing the bed over which the cloth passes that when the machine is set in motion, the bed shall move up and down in a vertical direction by self-acting means. As the cloth passes over this bed, and between it and the cutters, it follows that when the bed is raised the nap of the cloth is cut shorter, and that when the bed is lowered the cloth is left longer in the nap. This variation in the length of nap produces lines or stripes running transverse across the piece from bit to bit. *Patent completed.*

1061. T. LACEY. "Improvements in gas regulators." Dated April 27, 1859.

This consists in suspending and supporting a conical valve by a diaphragm of thin sheet caoutchouc or caoutchouc fabric in a tube or ring; in covering the top of the tube by a cover; in carrying a spindle from the upper part of the conical valve through a central aperture in the cover; in fitting a valve on the spindle having its seat on the top of the cover; and in forming a communication with the atmosphere from the chamber in which the upper valve rests, and through the aperture in the cover to the top of the diaphragm and valve. There are modifications included. *Patent completed.*

1062. Sir T. T. GRANT, K.C.B. "Improvements in ships' cooking apparatus." Dated April 27, 1859.

The patentee employs an apparatus of the following construction:—It consists of a fireplace or furnace combined with a boiler; the fireplace is at the front of the boiler, and the two edges or cheeks thereof are formed by water spaces in connection with the boiler; the bottom of the ash-pit also is formed in a similar manner. The top of the fireplace is formed of metal slabs, which serve as a hot plate. The back or bridge of the fireplace is formed by a water space also in communication with the boiler. Behind the hollow bridge is a chamber from which a series of small tubular smoke flues pass to a chamber at the back of the boiler in which ovens are placed; this chamber communicates directly with a chimney placed at the back of the apparatus. Over the boiler a steam chamber is formed which receives steam from the boiler by a pipe ascending from the top of the boiler, and terminating in a dome formed at the top of the steam chamber; this arrangement is to prevent water being forced over with the steam into the steam chamber. Within the steam chamber one or more cooking chambers are placed, and they are supported so that a space may be left for the steam around the said vessel or vessels. Cocks are provided at the exterior of the apparatus. On each side of the steam chamber brackets are fixed to support kettles or vessels which are supplied with steam by steam pipes connecting them with the steam chamber, and these vessels receive smaller vessels in which cooking may be carried on. *Patent completed.*

1063. T. GAUNTLEY, sen. "Improvements in the manufacture of fringes." Dated April 27, 1859.

Here twist lace machines are used, so that the warp threads are employed for producing the fringe as well as the traverse threads of the woven parts or heads of the fringe, and the bottom or carriage threads are employed to produce the longitudinal threads of the woven parts or heads of the fringe. The warp threads are shogged or moved to and fro a distance equal to the desired width for the fringes. *Patent abandoned.*

1064. J. KIDD. "Improvements in sewing machines." Dated April 28, 1859.

The inventor claims the principle of working the needle and the shuttle by one crank pin by means of the slots described. The principle of a shuttle moving in grooves in a race, and supported by the keels described. The principle of a feeder hanging on a centre and worked by the needle arm and needle slide, and the principle of the guide bar forming a guide and a regulator. *Patent abandoned.*

1065. C. RANDOLPH and J. ELDER. "Improvements in steam-engines and boilers." Dated April 28, 1859.

The patentee claims, 1, communicating the power of the engines to screw or similar propellers by mechanism capable of giving, either a direct connection with equal speed, or an increased speed by means of an indirect connection as described. 2. Constructing surface condensers with spiral or helical coils of pipes. 3. Constructing marine steam-boilers with two or more separate uptakes to each separate vessel or boiler, and the surrounding of such uptakes with steam drying or superheating chambers. 4. Arranging the tubes or corresponding passages of multitubular or similar steam-boilers with a downward inclination towards the smoke boxes. 5. Constructing combined heaters and steam generators as described with reference to the drawings. *Patent completed.*

1066. R. JONES. "An improved safety lamp." Dated April 28, 1859.

This consists in the lamps being provided with an extinguishing apparatus secured to the moveable head of the same through the medium of pendant framework, and so arranged as to admit of two metallic surfaces being brought immediately in contact with the wick on withdrawing the head, by which the light is extinguished, the draught holes being covered with gauze, and the lamp provided with the ordinary wire gauze, glass, lock-up head and handle, as also a flat wick, in place of the usual round one; a reservoir of oil is contained in the head, together with a pipe and thumb valve for supplying the burner. *Patent abandoned.*

1067. R. HARRINGTON. "Improvements in umbrellas and parasols." Dated April 28, 1859.

This relates to the construction of the runners, the object being to enable a parasol or umbrella to be placed in an excentric position to the handle or stick. *Patent completed.*

1068. N. LIBOTTE. "A steam brake for mines, which may also be worked by hand." Dated April 28, 1859.

The patentee claims, 1, a method of arranging, combining, and constructing mine breaks, so that a wheel may be acted upon to operate as a break by the application of friction or pressure against or upon the sides thereof. 2. An arrangement and combination of break in which a wheel having projections and sunken parts is acted upon by the pressure exerted on its sides by bars having projections corresponding to the recesses in the wheel, and operating as described. *Patent completed.*

1069. N. J. HOLMES. "Improvements in electric telegraphs, and apparatus connected therewith." Dated April 28, 1859.

The patentee claims, 1, the use of coils constructed so as to secure to any transmitted or received current an inductive influence always parallel to the axis of motion and polarity of any magnetized substance placed within the sphere of that influence, either externally or internally. 2. The use of such construction of coils whereby the polarity of the needle or indicators is always preserved at a uniform distance from the influence of the coil during the motion derived from any transmitted or received current. 3. The particular arrangements of conductors and parts necessary to secure these maximum effects of any current upon any magnetized or indicating apparatus, or apparatus used either for direct transmission of signals, or for local action, either as a visible, audible, or printing telegraph. 4. The use of two parallel or diverging magnetized needles, or other indicators used in combination with the parallelism of axis of motion with the direction of inductive influence of electric currents, so that each needle is in opposition to the axis of such inductive influence during any motion derived from any current or currents. *Patent completed.*

1070. E. LARDENOIS. "Improvements in the manufacture of pulp for paper, pasteboard, and other like articles." (A communication.) Dated April 28, 1859.

This consists in manufacturing pulp from vegetable substances without rags, by subjecting them, 1st, to the action of steam; 2nd, to the blows of heavy hammers, and to pressure between rollers; 3rd, to solutions of protoxide of sodium under pressure; 4th, to universal acids and to washings in water; 5th, to chlorine or chlorides, to carbonic acid, to oxalic acid, to heat, to galvanic currents, and to pressure. *Patent completed.*

1071. T. CLARKE. "Improvements in sheaves or pulleys for paying out and hauling in ropes, chains, and cables, for communicating motion to machinery, and for other useful purposes." Dated April 28, 1859.

This consists in constructing sheaves or pulleys in two parts, so that one or both of the flanges or sides of the groove in which the rope or cable travels shall be capable of being moved so that the two may be brought together or towards each other at one part of the circumference of the pulley, and nip or grip the rope at that part, while the ropes may travel freely over the other part of the pulley. The motion of the moveable part or parts, and therefore the gripping action, are produced by weighted levers, springs, inclined axles or otherwise. The gripping faces of the flanges or sides of the groove may be furnished with roughed steel plates, or with vulcanized rubber. *Patent completed.*

1072. J. WHEAT. "Certain improvements in drilling-machines employed for agricultural purposes." Dated April 28, 1859.

In carrying out this invention a wooden barrel is connected by a spindle to a suitable framing, and around this barrel a chain passes right and left, and is guided on to a half round wood gearing to which the ends of the chain are securely fixed; on the top of the spindle of the aforesaid barrel a handle is placed, by moving which handle from right to left, or *vice versâ*, the course of the machine will be directed as required. *Patent completed.*

1073. W. A. TOMPSON and W. GREEN. "Improvements in apparatus for applying liquids to the throat and air passages for medical purposes." Dated April 28, 1859.

The patentees employ a flexible or other gas-holder or vessel containing an under pressure, and they connect this gas-holder or vessel with a pipe, by means of which a jet of air can be directed on to the interior of the throat of the patient. Before the air passes to the throat they cause it to become saturated with a

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mist of the liquid (usually a solution of the nitrate of silver) which they desire to apply. This is effected by causing the air from the gasometer to pass into a small egg-shaped vessel of glass containing a few drams of the solution; the air is caused to enter near the upper part of the vessel on one side, and to issue from the top of the vessel to the escape tube or jet by which it is applied. The vessel which holds the solution also contains a piece of glass rod having a number of capillary passages formed from end to end of it, and one end of this rod rests in the liquid, while the other rises above it. The air in entering impinges on the surface of the liquid, and forces it through the passages in the rod; it is thus brought within range of the current of air, and is carried by it through the escape tube or jet. At the end of this tube there is a covering of very fine gauze of silver wire, through which the solution can escape to the throat only in an extremely divided state; the connection between this tube and the solution vessel is formed by a vulcanized india-rubber tube. *Patent completed.*

1074. A. BOYLE. "Improvements in the manufacture of certain parts of umbrellas and parasols." Dated April 28, 1859.

This relates to machinery whereby the ribs of umbrellas and parasols may be made from wire with greater facility and dispatch than heretofore. The stamp or fly presses for forming or straightening the ends or tips of the ribs are dispensed with. Sets of sliding bolts are arranged to work either horizontally or vertically, and to these bolts suitable dies or tools are affixed, and the bolts and dies are acted upon by cams, levers, or cranks, which derive their motion from a shaft provided with a fly wheel, and driven by any suitable gearing. The dies will then be made to perform the operations of flattening the tip and notch ends of the ribs, and also forming the indentation for the middle bit or joint (to which the stretchers are affixed) simultaneously or in rapid succession. *Patent completed.*

1075. W. M. CRANSTON. "A grass-cutting machine." (A communication.) Dated April 29, 1859.

This invention is not intelligibly described apart from the drawings. *Patent completed.*

1076. W. CORBETT and W. CARMONT. "Certain improvements in the construction and arrangement of furnaces employed in the manufacture of iron and steel, and for other similar purposes." Dated April 29, 1859.

This consists, 1, in the use of a brickwork shield over the metal hearth for the prevention of all deleterious contact, whether arising from the gases of combustion, or from solid matters, as coke, &c., getting into the iron, &c., from the furnace. 2. In the use of a diaphragm or partition between two metal hearths heated from one furnace for greater convenience in the conversion of iron or steel. 3. In the use of a hopper with a self-acting arrangement of mechanism for the gradual supply of "physic" to the furnace or furnaces in the conversion of metals. *Patent completed.*

1077. J. W. WELCH. "Improvements in sizeing or dressing yarns or threads for weaving." Dated April 29, 1859.

This consists in sizeing or dressing yarns or threads for weaving, with a combination of substances not heretofore used for that purpose. To this end the patentee employs gelatine derived from animal substances combined with sulphate of magnesia. *Patent completed.*

1078. H. BOSSHARD. "An improved mechanism for obtaining and imparting motive power." Dated April 29, 1859.

The inventor proposes to construct a motor or driving apparatus capable of being motioned by wind, water, or other natural power, to consist of an arrangement of wheels and shafts usually known as clockwork. *Patent abandoned.*

1079. E. A. PORTEUS and W. H. BURKE. "Improvements in printing and other presses." Dated April 29, 1859.

In constructing a press according to this invention motion is communicated to the platten or moveable part of the press in the following manner:—An axis with a lever handle, or other instrument for giving a partial rotation thereto, is used, on which axis there is a boss or projection, against which, and in suitable notches or recesses formed at opposite parts of its periphery, two of the edges of the two rectangular plates press; the other edge of one of these plates is received into a notch or recess in the platten, or other moveable part of the press, and the other edge of the other rectangular plate is received in a notch or recess in a cross-head or other reaching part of the press. It is preferred that the two edges of each plate should be formed into knife-like edges, and that they should be received into corresponding notches or recesses, but this may be varied. By this arrangement the platten or moveable part of a press will be acted on very powerfully by the lever or other means used for causing the axis to rotate partly round, in consequence of the two plates being thereby brought more nearly into the same plane. When making a lithographic press the patentees employ a friction roller under each of the axes or necks of the cylinder or roller, over which the carriage of the press moves, and in order to ensure greater accuracy in the movement of the platten they prefer to apply apparatus as above described at both ends of the platten. They apply V or angular guides to the two ends of the platten. *Patent completed.*

1080. S. DE CAZENAVE. "An improved lubricating compound." Dated April 29, 1859.

The inventor mixes together oil ricini or castor oil, soft or potassa soap, palm oil, and virgin or American rosin, and melts them at as low a temperature as possible. He then adds, in a finely powdered state, bichlorate of mercury and pumice stone, and well mixes and incorporates the whole while warm. *Patent abandoned.*

1081. T. SMITH. "Improvements in cultivating implements." Dated April 29, 1859.

This relates to an implement which may consist of one or more sets of tines or teeth, and the forms of the tines or teeth may be varied, and such ends or points may be moveable, so that one implement may at different times work with different forms of points or ends to the tines. The tines are bent, the forward edges being concave, and the hinder edges convex. When having a single set or a row of tines or teeth across an implement, the upper end of each tine is fixed to a bar, either permanently or moveably, so as to admit of their distances apart being varied. The bar to which a set or row of teeth or tines is applied is connected by links to a lever which has its axis at or near the front of the implement. The tines or teeth move on an axis which passes through the whole of them, and the parts are so arranged that, by depressing the hinder end of the lever, the points or lower ends of the tines or teeth are lifted out of the land, and the parts are in equilibrium or nearly so, in order that it may not require much effort to lift the tines or teeth. The implement is mounted on wheels, one on each side, and one or two in the front. There are modifications included. *Patent completed.*

1082. W. WINSTANLEY and J. KELLY. "Improvements in pumps, and gearing and appliances for working the same." Dated April 29, 1859.

The patentees claim surrounding the head of the suction pipe with an air-tight chamber or casing, and elevating the discharge orifice of the suction pipe to a point above the level of the lower valves of the pumps. The application to pumps of the peculiar syphon-shaped discharge part as described. The peculiar arrangements for jointing together the lift valve and pump rod as described. Connecting fog horns to the air vessels of pumps by india-rubber tubing. *Patent completed.*

1083. J. TOUSSAINT. "A new process of modelling and moulding for galvano-plastic." Dated April 30, 1859.

The object here is the reproduction by electricity, in hollow or in relief, of leaves, flowers, fruits, shrubs, reptiles, fishes, birds, insects, shells, animals, and all objects, animate or inanimate, in groups or separately. *Patent completed.*

1084. J. DARLINGTON. "Improvements in zinc retort furnaces." Dated April 30, 1859.

This consists in so constructing retort or muffle furnaces used for the reduction of zinc ores, that hot or cold air may be forced through and among the fuel employed, so as to render the same incandescent, and so that coal may be supplied at the side in a caked or coked state. *Patent completed.*

1085. G. FRANCIS. "Improved apparatus applicable to the treatment of tea and other useful purposes." Dated April 30, 1859.

This apparatus consists of a horizontal flat sieve or riddle, with a vertical circular side, which the patentee forms either solid or perforated, and which he mounts upon a suitable frame work or stand. Above this sieve or riddle he constructs horizontal radial arms which spring from a vertical revolving centre shaft. These parts are enclosed in a suitable cover to confine the dust and so forth, and the top is provided with a hopper for introducing the tea, &c., to be operated upon. There is a receptacle below the sieve or riddle into which the tea, &c., falls when acted upon by the revolving radial arms and passed through the meshes of the sieve or riddle. The shaft carrying the radial arms is caused to rotate by the power applied through the meshes of the sieve or riddle. The shaft carrying the radial arms is caused to rotate by the power applied through a wheel and pinion, or any other suitable contrivance. *Patent completed.*

1086. J. MORISON, sen., and J. MORISON, jun. "Improvements in looms and in apparatus connected therewith." Dated April 30, 1859.

This relates, 1, to certain improvements in jacquard apparatus of the kind used for acting upon leaves of heddles in the production of ornamental fabrics. 2. To certain improvements in details connected with shifting shuttle boxes; and 3, to an improvement in shuttles. The details are too voluminous to be quoted here. *Patent abandoned.*

1087. W. CLARK. "Improvements in ventilating or supplying air to diving bells and divers, and in holding communication therewith from above." (A communication.) Dated April 30, 1859.

Here a blowing apparatus is placed in position where the descent is to be made; on the shore or in the boat, raft, &c., are established two tubes of gutta percha or india-rubber of a length in proportion to the depth to be explored or operated in. One of the extremeties of each of these tubes is in communication with the diving apparatus, one of which is open to the air and furnished with a speaking trumpet or funnel, while the other is joined to the induction tube of the blowing machine. The other extremity of each of these tubes is connected to the diving bell or other receiver, being firmly united to one of the two junctions which communicate with the interior thereof. Thus the interior of the receiver is on the one hand in communication with the exhausting tube of the blowing machine, and on the other hand with the atmosphere. In connection with the latter communication in the interior of the receiver is an india-rubber flexible tube, of just sufficient length to descend to the level of the mouth of the diver, and which has at its extremity a small mouth piece to facilitate conversation with the diver. The extremity that is free to the atmosphere for speaking has a similar arrangement of parts for speaking or hearing. The apparatus thus established, and the diver being in the bell dressed in a dress of gutta-percha, &c., it is sufficient to put the apparatus to work, to work the blowing machine in order to produce the ventilation of the bell. The foul air in the bell is drawn off by the blowing machine, while the fresh air arrives by the second tube. *Patent completed.*

1088. A. MCKECHNIE. "Improvements in hammers and in apparatus for working the same." Dated April 30, 1859.

This relates to mechanically actuated hammers of frictional action, whereby variable blows may be given with rapidity, ease, and certainty, whilst the machinery is simple, &c.; the hammer can be suspended at any point required. We cannot give space to the details of the invention. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Aug. 2, 1859.

1784. H. Fletcher. Certain improvements in sewing and embroidering machinery.

Dated Sept. 16, 1859.

2110. T. Richardson. Improvements in the manufacture of sulphuric acid and in applying the heat generated in the process.

Dated Sept. 27, 1859.

2180. F. Simpson. An improved method of fastening or securing envelopes and other like receptacles, also for affixing postage stamps, receipt stamps, and all other similar labels requiring adhesive properties.

Dated Oct. 5, 1859.

2254. J. A. Herbert. Manufacturing of oxychloride of lead. (A communication.)

Dated Oct. 13, 1859.

2338. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith. Improvements in the manufacture of bread, biscuits, and like articles, and in the machinery and apparatus connected therewith.

Dated Oct. 19, 1859.

2390. J. K. Blackwell. Improvements in reverberatory and other furnaces. (A communication.)

Dated Oct. 24, 1859.

2426. P. M. A. Laurent. Certain improvements in eye-glasses for optical instruments.

Dated Nov. 4, 1859.

2519. J. G. Meyer. The employment of the "tacca pinatifida" as a substitute for straw now used in various manufactures.

Dated Nov. 10, 1859.

2558. S., W., and H. Evans. Improvements in polishing thread and yarn, and in machinery to be employed for that purpose.

Dated Nov. 15, 1859.

2384. W. H. Ward. Improvements in wheels for railway engines and carriages.

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Dated Nov. 16, 1859.

2596. C. Green. Improvement in the method of applying heat in the manufacture and drying of salt.

2597. W. Baker. Apparatus to facilitate the delivery of coins, for the giving of change and the like.

2598. W. Johnson. Improvements in gas-burners. (A communication.)

2599. R. White. Improvements in shirts.

2600. T. Greenwood and J. Batley. Improvements in the construction of the beds of lathes, and the tables of planing machines.

2601. G. Taylor. An improvement in the mode of manufacturing wrought iron crank axles.

2602. J. Burrow. Improvements in umbrellas and parasols.

2603. J. Ward and H. Burman. Improvements in machinery for making bricks and tiles, and for moulding peat and plastic substances.

Dated Nov. 17, 1859.

2604. J. A. Dricu and A. Legeay. A tissue, being a substitute for leather, mill-board, and papier-maché.

2605. L. White. Improvements in glass furnaces.

2606. D. Jones. Improvements in metallic casks.

2607. R. Laming. Improvements in obtaining alkalies and alkaline compounds.

2608. T. Robinson. Improvements in steam-engines.

2609. J. L. Jullion and G. Pirie. An improvement in the manufacture of paper.

2610. J. McKenzie and S. T. Wentworth. Improvements in breach-loading fire-arms.

Dated Nov. 18, 1859.

2611. J. H. Brierley. A belt or band-fastener.

2612. W. Gossage. Improvements in the manufacture of carbonate of soda.

2613. J. Pinchbeck. Improvements in consumers' compensating gas meters, which are partly applicable to ordinary consumers' meters.

Dated Nov. 19, 1859.

2615. S. Corbett. An improvement or improvements in pulpers for pulping food for cattle.

2616. W. Clark. Improvements in the preservation of animal and vegetable matters. (A communication.)

2617. W. Blinkhorn. The novel application of certain materials to the manufacture of bricks, quarries, or tiles, to be employed principally in the construction of furnaces as fire-bricks.

2618. J. Knight. Certain improvements in or applicable to looms for weaving, part of which is applicable to lubricating axles and bearings for other purposes.

2619. E. Barlow and F. Hamilton. Certain improvements in carding engines.

2620. A. H. Le Pontois. Improvements in machines for distributing seed and manure.

2621. J. Bancroft. Improvements in the manufacture of fabrics adapted to be used for curtains, coverings of furniture, table covers, and such like uses.

2623. A. Godchaux. Improvements in the mode of printing forms, or models, or copies of penmanship and designs on paper, and other fabrics.

2624. J. Petrie, jun., and J. Lord. Improvements in machinery or apparatus for drying rags, wool, and other fibrous materials.

2625. A. V. Newton. Improvements in the mode of and machinery for drying cloths. (A communication.)

2627. G. Laidlaw. Improvements in hats, and other coverings for the head.

2628. H. Naylor and W. Crossley. Improvements in pickers used in looms for weaving.

Dated Nov. 21, 1859.

2630. P. Jochem. Improvements in brakes for railway and other carriages.

2632. J. Cowan. Improvements in "bracing" or connecting the angles or corners of chairs, and other like articles of cabinet-furniture.

2636. J. Apsey and W. G. Buckwell. Improvements in boilers and other furnaces, smoke consuming and steam generating.

Dated Nov. 22, 1859.

2638. E. T. Hughes. Improvements in weaving silk and other materials, and in the machinery or apparatus employed therein. (A communication.)

2640. J. Shand and J. Rowley. Improvements in fire-engines, parts of which improvements are applicable to other pumps.

2644. W. E. Newton. Certain improvements in obtaining compensation for the effects of changes of temperature in time-keepers. (A communication.)

2646. R. Mushet. An improvement or improvements in the manufacture of iron and steel.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Dec.* 6, 1859.)

1722. J. B. Whitehall and S. Wheatcroft. Cap fronts.
1729. G. Davies. Dyeing. (A communication.)
1732. C. F. Vasserot. Preventing incrustations in boilers. (A communication.)
1734. W. H. Buckland. Peat.
1736. P. D. Mickles. Springs. (A communication.)
1739. D. B. Hale. Garment for ladies. (Partly a communication.)
1744. J. Scoffern. Waterproofing, dyeing, &c.
1750. W. Kent. Self-acting fan.
1752. J. Aspinall. Evaporating.
1755. J. Jackson. Metal pens.
1761. P. A. Viette. Engraving.
1766. F. Haeck. Refrigerating apparatus.
1782. E. de Bassano. Artificial fuel.
1784. H. Fletcher. Sewing and embroidering.
1787. A. Pin. Paint.
1788. J. Hewett. Water closets.
1798. J. Horton. Water gauge.
1824. R. A. Brooman. Preventing incrustations in boilers. (A communication.)
1851. W. K. Westly. Heckling flax, &c.
1862. W. Clark. Oscillating engines. (A communication.)
1882. C. Glassborow. Pianos.
1932. G. Riley. Refrigerators.
1976. H. Hutton. Lubricator.
1984. J. Mackenzie and S. T. Wentworth. Fire-arms.
2165. A. R. L. Normandy. Cooking food.
2208. A. W. Williamson and L. Perkins. Steam boilers.
2336. W. Burgess. Reaping and mowing machines.
2338. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith. Bread, biscuits, &c.
2352. J. Fernihough. Steam boilers.
2359. R. Smith. Purifying water.
2398. R. Hobson. Producing devices.
2524. G. T. Bousfield. Polishing glass. (A communication.)
2539. C. Green. Tubes.
2568. W. Burgess. Mowing and reaping machines.
2576. A. Applegath. Surface block printing.
2599. R. White. Shirts.
2601. G. Taylor. Crank axles.
2621. J. Bancroft. Curtains, &c.
2627. G. Laidlaw. Hats.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Dec. 2, 1859.

1371. J. Burrow and W. N. Wilson.
1378. J. and W. Wood.
1383. J. Ferrabee.
1388. W. B. Nation.
1573. S. Fisher.
2022. F. C. Bakewell.
2377. J. Reynolds.

Sealed Dec. 6, 1859.

1395. C. de Bergue.
1396. J. B. Howell, J. Hick, and W. Haegreaves.
1408. G. J. Farmer and G. B. Hardy.
1413. M. H. Picciotto.
1423. H. L. Corlett.
1447. C. H. Waring.
1465. A. V. Newton.
1504. W. Russell.
1507. M. A. F. Mennons.
1514. H. Doulton.
1517. J. Mills.
1518. A. Chesneau.
1531. W. Coppin.
1535. B. Burton.
1550. G. Chapman.
1563. C. H. G. Williams.
1639. F. C. Bakewell.
2038. E. R. Daun and E. Goldschmidt.
2112. J. Beck.
2276. E. O. Tindall.
2278. A. M. Ferry.
2309. J. Earl.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2330. J. Gibson.
2341. E. J. Emmons.
2349. J. Longbottom.
2361. F. Siemens.
2363. T. Crabtree.
2369. J. Denis.
2374. J. Apperly and W. Clissold.
2378. E. D. and G. Draper.
2382. A. E. L. Bellford.
2384. D. Crawford.
2396. C. Schiele.
2398. J. Longbottom.
2420. W. Lund.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

936. J. Norton.
939. J. Newall.
983. J. H. Johnson.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Dec. 2, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
830	0 9	1037	1 3	1049	0 3	1060	0 10	1071	0 9	1082	0 10
966	0 3	1038	0 8	1050	1 4	1061	0 7	1072	0 6	1083	0 4
1028	0 7	1039	0 10	1051	0 9	1062	1 10	1073	0 6	1084	0 6
1029	0 8	1040	0 4	1052	0 3	1063	0 3	1074	0 10	1085	0 7
1030	0 4	1041	0 3	1053	0 8	1064	0 3	1075	1 0	1086	0 8
1031	0 10	1042	0 7	1054	0 3	1065	2 6	1076	0 6	1087	0 3
1032	0 3	1043	0 10	1055	0 4	1066	0 3	1077	0 3	1088	0 3
1033	0 7	1044	0 4	1056	1 3	1067	0 7	1078	0 3	1089	0 3
1034	0 3	1045	0 7	1057	0 3	1068	0 7	1079	0 10	1090	0 4
1035	0 6	1047	0 3	1058	0 11	1069	0 7	1080	0 3	1091	0 4
1036	0 3	1048	0 4	1059	0 3	1070	0 4	1081	0 10	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

RAILWAY IRON, *Scinde Railway.*—For from 6,000 to 7,000 tons of rails, with a proportionate quantity of fish-plates. Tenders, 10 o'clock morning of 13th inst, Gresham House, Old Broad-street.

SLEEPERS, *South Wales Railway.*—For the supply of 10,000 sleepers. Specification at the Chief Office, 10 Eastbourne-terrace, Paddington; or office of Mr. W. G. Owen. Company's Engineer, Gloucester. Tenders, December 15th.

CARRIAGE TYRES AND AXLES, &c., *South Eastern Railway.*—For carriage tyres and axles, cast iron boxes, wrought iron rings, axle boxes, buffer rods, horse-hair, and plate-glass. Specifications, patterns, &c., Station-master's office, Bricklayers' Arms Station, Old Kent-road, London. Tenders endorsed "Tenders for Stores," to Mr. S. Smiles, Secretary, Dec. 14th.

WAGGONS AND TRUCKS, *South Eastern Railway.*—For the supply of 100 new goods waggons, 100 new coal waggons, and 50 new timber trucks. Patterns, &c., Station-master's office, Bricklayers' Arms Railway Station, Old Kent-road, London. Tenders endorsed "Tenders for New Waggons," to Mr. S. Smiles, Secretary, Dec. 1.

WATER-WORKS, *Heywood.*—For the execution of the earthwork, puddling, and masonry required in raising the embankment of the upper reservoir of the Heywood Water-works Company, near Naden Head, in the Township of Spotland; and for other works. Plans at the offices of Messrs. Cawley and Radford, Civil Engineers, 41 John Dalton-street, Manchester. Tenders, Secretary of the Water-works Company, Heywood, Dec. 22nd.

SEA WALL, *River Wear.*—Commissioners.—For the work required in the erection of a sea wall, near the south outlet in front of the battery intended to be erected there. Plans, &c., Engineer's Office, Commissioner's Quay. Tenders, Executive Committee of the River Wear Commissioners, endorsed "Tenders for Sea Wall, South Outlet," Dec. 13th.

FARM, *Homestead, Lamnton.*—Plans, offices of Mr. Wilkinson, architect, Oxford. Tenders, Dec. 10th.

HEATING APPARATUSES, *Chelsea.*—For the heating of the new vestry hall. Plans, &c., office of Mr. W. W. Pocock, 10 Trevor-terrace, Knightsbridge. Tenders to Dec. 17.

WARMING CHURCH, *Rugeley.*—For warming the church with a hot-water apparatus. Tenders, accompanied by a plan and specification to the Churchwardens of Rugeley, under cover to Mr. James, bookseller, &c., Dec. 17.

SEWAGE, *Warrington.*—For the construction of main sewers with their appurtenances embodied in contracts 10 and 11. Drawings and specifications, Mr. Benjamin P. Coxon, borough engineer. Tenders for each contract a separate tender, Chairman of the Paving and Sewerage Committee, Town Hall, 6 p.m., Dec. 12.

DESIGNS AND ESTIMATES FOR CEMETERY, *Sittingbourne, Kent.*—For designs, &c. (free of expense), for the erection of two chapels and an entrance lodge, with entrance gates, and for boundary, fencing, draining, and laying out the ground, which is square in form and three acres in extent. Average number of burials sixty per annum. The architect of plan adopted will be employed to superintend the works, all other plans will be returned to the owners. Plan of ground, &c., Mr. G. Harris, clerk to the burial board. Designs and estimate, Dec. 14.

FOREMAN AT IRONWORKS.—For a forge in the vicinity of Manchester, must have a thorough practical knowledge of puddling and roller, and be provided with first-class testimonials as to character and ability. Address, stating age, references, and where last employed, Y 39, *Manchester Examiner* Office.

OVERLOOKER.—Overlooker for twenty puddling furnaces and two bar-mills. Box 70, post office, Wolverhampton.

CLERK OF WORKS.—Sowerby Bridge Cemetery, to superintend the erection of chapels, lodge, boundary walling, draining, and approach road to the works. Terms, experience, and testimonials "To the Chairman of the Cemetery Committee," Dec. 14, before 12 o'clock, a.m.

BRASS FINISHERS AND MOULDERS.—Wanted first-class workmen at an old established London firm. Apply by letter, stating full particulars, to Mr. J. J. Taylor, 114 Fenchurch-street. A preference given to those accustomed steam-cock work.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 16, 1859.

AN AMERICAN SHIPBUILDER ABROAD.

We announced to our readers a few weeks since that Mr. Donald McKay, shipbuilder, of Boston, United States, had arrived in this country on a professional tour. Remembering the outcry which was made eight or nine years since, when we happened to reduce Mr. Griffith's American volume on Shipbuilding in the crucible of English science, we resolved, as soon as we heard of Mr. McKay's arrival, to do our best to show him all the consideration which so distinguished a member of a distinguished profession and a distinguished nation deserves. We feel compelled now to offer a few remarks concerning our visitor's opinions and statements, in which we shall be found to differ seriously from him, but hope to do so without departing in the least degree from our resolution.

Many facts respecting Mr. McKay's present visit to England and his contemplated tour on the Continent of Europe became privately known to us from time to time, but the first thing which brought the subject formally under our notice was the receipt of a printed paper, bearing a London imprint, and entitled "A "Practical Refutation of the English Pre-"judices regarding the Durability of Ame-"rican-built Ships and American Timber. "Illustrated by a List of American Ships "(Merchant, Men-of-War, and Steam Ships); "distinguished by their Long Durability. "Prepared by Donald McKay, Shipbuil-"der, of Boston, United States." On the title-page we are informed that these lists of ships were prepared for the purpose of "proving "by facts" that ships built with carefully selected American timber—viz., live oak, white oak, pitch pine, &c.—will last as long as ships built with the best English oak, "in "contradiction to the views entertained by "Lloyds' Committee, and in support of the "favourable opinions entertained by British "merchants in regard to the efficiency and "safety of American ships." We are likewise told that this paper is extracted from the manuscripts of "a comprehensive and richly illus-"trated work" on the theory and practice of Naval Architecture, which is shortly to be published by Mr. McKay.

On examining the paper we find that it comprises, first, a list (extracted from the *New York Marine Register* for 1859) of merchant vessels built in America, and with American timber, that have been found in an efficient sea-going state after more than twenty years of service, and are yet in actual service in 1859. This list gives 102 ships of an average age of 24 years; 40 barques of an average of 25½ years; 54 brigs of 25 years; and 12 steamers averaging 18½ years. We think we need hardly say there is nothing extraordinary in this list. If Mr. McKay will take the trouble to look through Lloyd's list, and to count the number of English-timber-built ships therein of an age exceeding 20 years (an operation which we have not leisure to amuse ourselves with) he will find that his American list will stand no sort of comparison with that for which Lloyd's furnishes material. We have glanced casually through Lloyd's list, with this question in view, and we predict that if Mr. McKay will do the same he will be not a little astonished. We have, we venture to say, many scores of vessels not only 24, but between 50 and 100 years of age; indeed, there are several vessels in our Custom House Registry more than 100 years old.

The paper next deals with men-of-war, and enumerates 9 line-of-battle ships averaging 38½ years of age; 5 frigates averaging 26 years; and 19 sloops and 4 brigs averaging 22 years. At the end of this list Mr. McKay asks, somewhat triumphantly as it seems to us,—"Can the Eng-"lish navy present a result more satisfac-"tory than this?" Now, in considering this question, we must remind ourselves and our readers that all Mr. McKay tells us of these ships is, that they are "in perfect preservation "and in an efficient state up to this date." Well, if this be all, we may answer at once,—"The English navy *can* present a result more "satisfactory than this." In the English navy we have 9 line-of-battle ships, not only over 38½ years of average age, but of 50 years of age—every ship of them—and all "in perfect "preservation and in an efficient state up to "this date." These are the Ajax, Implacable, Foudroyant, Victory, Egmont, Queen Charlotte, Impregnable, Hogue, and Edinburgh. We have upwards of *twenty* such ships individually of the age of Mr. McKay's average. So much for line-of-battle ships. As to frigates we venture to say we have nearly half-a-hundred of them each reaching Mr. McKay's average of five frigates, viz., 26 years; and in smaller sailing ships also we doubtless exceed his average of 22 years. With regard to steamers of war, it is only necessary to say that against *nine* American which Mr. McKay mentions, averaging 14½ years, we could set as many averaging *double* that age! We have at least *forty* reaching Mr. McKay's average. Only last week we were ourselves looking at the Salamander sloop in the basin at Deptford Dockyard—a ship built 27 years since—and learnt that new boilers are preparing for her at the Sheerness factory, in the expectation that after certain necessary repairs are made, she will still be perfectly sound and fit for service. We need hardly enlarge upon these points.

Mr. McKay appends to his list of United States men-of-war ships over fifteen years of age a foot-note, which stands thus;—"The term "[15 years] assigned to the average duration "of British men-of-war ships, after which they "require a complete and extensive repair. "*Statement of the Surveyor of the Navy.*" But if the Surveyor of the Navy's remark is rightly interpreted, it implies nothing whatever in Mr. McKay's favour. Does he wish us to think that the American ships averaging 38½, 26, and 22 years of age have never undergone such repairs as the Surveyor refers to? Surely not. If they have not, we should like to possess some authentication of their alleged state of "perfect preservation" and efficiency.

The next and last division of Mr. McKay's printed paper consists of certain tables and observations on the weight and strength of American ship-timber, which we reprint, for the sake of convenience, upon another page. The frames of American ships of war are built of "live oak," their planking being of "white oak;" and live oak and white oak take prominent places in these tables and observations. To tell the whole truth, we ought also to say that one part of Mr. McKay's business in this country appears (from what has passed between him and some of our shipbuilders) to be to get orders for American timber—white oak in particular. He would have us believe, as the article on another page shows, that American white oak is not only equal, but superior to English oak: "the advantage of lightness combined "with strength, is entirely on the side of "American white oak." It is all very well for him to state the case in this way, but we must guard shipbuilders against proceeding blindly in the matter. American white oak is a thing of very variable nature. The States' white oak (which is generally better than the Canadian) is of totally different qualities when grown under different circumstances. That grown on the hardy soils near the sea-coast, where it is subjected to the rude retarding influences of wind and storm, possesses a stoutness and strength which is nowhere to be found among the oaks that spring up in the moist inlands rapidly and untried to maturity. The timber from trees of the latter class—a light and free-splitting material—is what we see most of in this country, and what, we fear, is most frequently used in America itself. If it does not pay the Americans to use the high-priced better kind, it is exceedingly doubtful whether we can afford to do so.

But we can do more than place our opinions in antagonism to Mr. McKay's. Examples of the failure of the American white oak as a shipbuilding timber—of its early and general decay, that is—have come under our notice even in the American war navy itself. The *Scientific American* of a few weeks since published an announcement, which we think may be reproduced here to good purpose. It is to the following effect:—"The steam frigate Minnesota, "which was found to be rotten, and is now "undergoing repairs at the Charlestown Navy-"yard, is only five years old, and has made but "one cruize. All her outside planking, from "the water-line to the plank-sheer, is decayed. "Many of her knees are also unsound, so that "she will have to be rebuilt to fit her for "service. All the decayed timber is white oak; "and some of the yellow pine, with which the "oak came in contract, is also rotten. Yellow "pine is considered rot-proof in consequence of "the great amount of rosin which it contains; "but the presence of the decaying white oak "produced eremacansis in the pine in this case, "in the same manner that a little leaven pro-"motes fermentation among a large quantity of "matter. The live oak in the Minnesota has "not been the least affected with the rot; it is "as fresh as when put in. These are important "facts for shipbuilders." We agree with our contemporary; these *are* important facts for shipbuilders—particularly for British shipbuilders, who must keep them in mind during Mr. McKay's stay among us.

Having had an opportunity of seeing the prospectus of Mr. McKay's contemplated work on the "Theory and Practice of Naval Architecture," we had almost persuaded ourselves that something of real value upon this subject was at last coming to us from America. But our expectations have been sadly stricken down during the last few days. Mr. McKay, like every other American, is writing home elaborate descriptions of what he sees in this country, and some friend (or enemy) of his at home has published extracts from his letters in the American journal before referred to. In these extracts we find things which greatly depress our estimate of Mr. McKay's professional ability. That he should tell his friends (as he does) that the clipper ship Lightning, designed and built by himself, "is this day considered "the swiftest sailing vessel under the British "flag," is perfectly natural; it is equally natural that he should "have no hesitation in "asserting that our (American) models for "speed are very superior to any that I have yet "seen in the Royal dockyards" of England. But in one part of his letter Mr. McKay expresses an opinion or two which certainly should be noticed. During his visit to Liverpool, he writes:—"The Donegal, of 101 guns,

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"is at anchor in the Mersey. She is of a very "full and clumsy model, and *does not seem* "*capable of going more than four knots with* "*steam and sail combined.* The man who de- "signed her appears to have derived his ideas "of naval architecture from a Dutch galliot. "Her model is a disgrace to the Board of Ad- "miralty that sanctioned it." Now, we shall write quite courteously when we say that these remarks render it almost impossible for us to feel any further respect for Mr. McKay's professional opinions. He goes to the Mersey and sees a splendid line-of-battle ship at anchor, and predicts a maximum speed of *four* knots under steam and sail together; whereas, on the 16th of July last this very ship, the Donegal, made at the measured mile at Plymouth, *under steam alone*, TWELVE knots within a fraction—11·912 knots being the exact speed recorded! The fact is that this ship, which this guest of ours deems a disgrace to the Admiralty, is an exceedingly good ship. In the Admiralty tables which we published in the spring we have the particulars of two ships of the line, the Conqueror and the Marlborough, of the same nominal and nearly the same indicated horse-powers as the Donegal, and in respect of speed the Donegal is the best of the three, that of the Conqueror being 10·853, that of the Marlborough 11·06 on one occasion, and 11·866 on another, while her's was, as we have said, 11·912. We will only add that the disgrace attaches itself in this case, not to the British Admiralty, but to the American shipbuilder who can deliberately pen such trash about us; and we almost feel as if a little of the discredit clung to us because of our condescending to refute the nonsense he has written.

THE FORCES USED IN AGRICULTURE.

WE are exceedingly proud of ourselves, we men. The spirit within us is very conscious of itself, and not a little ambitious. Not Plato's sense, not Bacon's wisdom, not Shakspere's poetry satisfies us. Genius may light the land, and cover the race with glory, but our conception of what man might and ought to be is still far from realisation. On the very mountain tops of thought our cry still is—Excelsior! Excelsior! This is one way of looking at ourselves. But there is another way of doing this—a way equally true and just, but marvellously different. Spiritually we are, for all practical purposes, unrivalled. No loftier beings, no brighter intelligences, meet us in the arena of life, and compete with us for gifts or blessings. But, physically, how differently we are placed! Here the dumb brute, the lifeless machine, not only compete with, but beat us. As motive-power machines especially, the beasts of the field outstrip us, and steam-engines, the works of our own hands, surpass us immeasurably.

At the Society of Arts, a few evenings since, Mr. J. C. Morton instituted a very interesting inquiry into the relative values of men, horses, and steam-engines as agricultural labourers, and the parts which they are severally destined to play in the fields and farms of the future. His paper is one of the most valuable contributions to agricultural literature that the past twenty years have produced, and well deserves the attention of scientific readers. Mr. Morton first points out the fact that there are three classes under which all the operations of the farm may be arranged, and they correspond exactly to the three forces which we have at our command. In the first, where the greatest uniformity obtains, the greatest power is needed; and a purely mechanical force, acting through levers, wheels, and pullies, is in this way sufficiently under our control for their performance, and this class of operations increases in extent and in importance with almost every permanent improvement of the land, that is, with everything which tends to the uniformity of its condition. In the second class, as much force is needed; but rocky subsoil, awkward hedgerows, crooked roads, and scattered produce, interfere with any possibility of uniform procedure. Some machinery more pliable than cranks and rods is needed by which to carry out the purpose of the mind; and here, therefore, it must work by means of the teachable and powerful horse. This class of operations diminishes in extent and importance with every permanent improvement of the soil, that is, with every removal of the obstacles referred to. In the third class, the care and cultivation of individual life, vegetable and animal, are concerned: no great power is needed, but there is need for the constant and immediate exercise of the will, varying, it may be, at every successive moment; and here, therefore, the human mind can work only by its most perfect instrument—the human hand. It is plain that everything by which, on the one hand, land is brought to a uniform condition, and by which, on the other, the quantity of its living produce is increased, will extend the first and last of these three fields of agricultural operations, and will diminish the necessity of employing horses. "And this," says Mr. Morton, "is no mere "speculation; it is the principal lesson of the "agricultural experience of the past few years."

The forces used in agriculture, thus considered, form a very extensive subject, and one upon which Mr. Morton has thrown much new light. In the first place, he makes a more particular comparison of steam-power, horse-power, and hand-power for the cheap performance of mere labour. In describing steam-engines the term "horse-power" is used as a unit of force, and is assumed to be equal to the pull or lift of 33,000 lbs. one foot per minute; and to this agricultural experience agrees. Mr. Morton says, for a pair of horses will draw a plough along with an average pull of 300 lbs. at an average rate of 2½ miles per hour, or 220 feet per minute, and this is the same as if the 300 lbs. were pulled over a pulley, or lifted that height in the time; and 300 lbs. lifted 220 feet per minute is just the same as 66,000 lbs. lifted 1 foot high per minute, which, as the performance of a pair of horses, is exactly the 33,000 lbs. each at which their force is valued by the engineer. But in a comparison merely of the cost of horse-power in the animal and in the engine the great superiority does not appear which really belongs to the latter. In addition to this, the performance of which they are severally capable must be taken into account. An ordinary 10-horse power locomotive agricultural engine will, according to the Chester judges of the work done by Fowler's steam-plough there, cost in coals, oil, water and attendance, and wear and tear of implement and engine (but excluding interest on capital employed), nearly 45s. a day, or about 4s. 6d. an hour, which is 5½d. per hour for each nominal horse-power exerted; but as the real force exerted is more often that of 20 horses in the case of a 10-horse power engine, we must really divide this by 2, and call steam-produced horse-power worth 3d. per hour. The cost of horse labour on 21 farms in different parts of this country, of which the particulars have been given to Mr. Morton, was 5d. per horse for each of the working hours of the year. Besides this, the estimated expense of Fowler's engine was excessive, and the nominal power of it was certainly below the actual force at which it could be worked with the estimated quantity of coal consumed—11 lbs. of coal per hour for every horse-power produced, which is the consumption named for Fowler's engine, and the majority did not consume more than six to eight pounds.

Again, a horse at plough with an average length of 120 yards of furrow, loses one-third of his time on the headland in the mere act of turning the plough. At the dung-cart not one-third of his time is employed in the actual conveyance of the load. Indeed, this loss of time is a necessary part of his employment, however he may be engaged. He can pull 33,000 lbs. one foot high in a minute, but he cannot keep that performance up for 10 hours at a time. On six farms, the details of which Mr. Morton has so ascertained as that all the ploughing, scarifying, harrowing, rolling, horse-hoeing, carting—all the horse-labour, in fact, on each—is converted into lbs. lifted so many feet per minute throughout the working year, he finds that the actual performance per hour through the year is not 33,000 lbs. one foot high in a minute, but more nearly one-half that quantity, varying from 14,000 lbs. in the lowest case to 19,000 lbs. in the highest. No doubt, even in the case of steam-power, there must be periods of waste labour—ploughs must be turned upon the headland even if it be done by steam—but these occasional periods of comparatively fruitless work are, as he says, no necessary condition of steam-power; it is better if maintained continuously, and machinery will be invented to reduce this waste time to a minimum with a positive advantage to the efficiency of the engine.

Moreover, the relative cost of the two forces is affected not only by the question of time during which each can be continuously maintained, but also by the quality of the performance of which each is capable. In threshing, uniformity of speed is a condition of good work; it is more easily maintained by steam-power than by horses. In ploughing, the avoidance of trampling and of pressure generally is almost a condition of good work, and it is more easily obtained by steam-drawn machinery.

We next come to the estimation of the cost of manual labour engaged in mere work—that is, where the least degree of skill is called for. From a series of statistical facts prepared by him, Mr. Morton finds that the mere force of a man, at a cost of say 3d. an hour, as equal to a lift (in four different instances) of 250, 330, 500, and 370 lbs. per minute; the two former being cases where the load has to be detached as well as lifted, and the third being performed under the influence of good harvest fare; and he compares this with the duty of the steam-engine—or 33,000 lbs. one foot high per minute for 3d. per hour, and also with the actual average performance of the horse—16,000 lbs. lifted one foot per minute for 5d. an hour. In order, at the best rate named, to do the work of the steam-engine, 66 men would be required at a cost not of 3d. but of more than 15s. per hour; and in order to do the work of the horse 32 men would be needed at a cost of 8s. instead of 5d. an hour. It is plain that if we can take much of the mere labour of the farm out of the hands of the labourer, and avail ourselves of steam-power for its performance, there is an enormous amount of saving to be made in the cost of agricultural production. It is plain that it is but folly in the labourer to think that as regards the *mere* labour of the land he can compete with either steam-power or with horse-power. It is manifestly, therefore, in the cultivation not so much of mere strength of

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body as of skill and intelligence, that the safety of the labourer lies.

As the matter at present stands, then, and confining ourselves to that large and increasing class of operations in which the power required is great and the process almost uniform, and looking only to the cost per unit of work done, we have seen that steam-power stands decidedly first in the race, horse-power is a tolerably good second, and the agricultural labourer is literally nowhere. There are, however, as Mr. Morton points out, two considerations which greatly affect the position of horse-power in this competition, and place it much farther back than it would at present seem to be. They both affect its fitness for those acts of cultivation where it is plain that there is the greatest room for an extended use of steam-power. We refer, first, to the injury done to the land by the trampling of draught animals; and, secondly, to that irregularity of employment on the farm for horses during the year, which in effect makes you keep upon a large farm several horses all the year round for the sake of their work during a few weeks of spring and autumn. We have not space to enlarge upon these two considerations, but the reader will see their very great importance without difficulty. Suffice it to say, Mr. Morton after making careful calculations estimates that by steam-power at least three out of every seven horses on arable land may be dispensed with all the year, at a cost not exceeding the cost of these horses during the three or four months when alone they are really needed on the land. The first class of operations then upon the farm, which includes the ploughing and turning of the soil, will be taken by steam-power out of the field of horse-labour, just as threshing, and cutting, and grinding have been taken by it out of the field of hand-labour.

To the second division of farm work Mr. Morton refers but very briefly. It includes such cases of ploughing and cultivation as are taken, by very rocky subsoil and very crooked hedgerows, out of the scope of the steam-driven plough; it also includes the lighter class of horse-work, such as harrowing and horse-hoeing, which, however, might very well be done by steam; and it more especially includes the work of carriage, which, considering the scattered position of the produce to be collected, and the crooked roads along which it must be drawn, he sees no probability, as long as these remain, of getting done except by horse-power and manual labour in the usual way. Mr. Halkett does, indeed, propose to remove these obstacles, and is therefore able to accomplish all by steam, although at what cost we at present know not.

The third class of operations includes the lighter work, requiring skill and thought as well as labour. The planting of a seed equidistantly within the land may be done by machinery, but the culture of the young plant, much of the hoeing of the land immediately around it, and its treatment during growth according to its condition, must be left to the hand. When ripe it may be harvested by horse-drawn implements; our corn crops are reaped, our potatoes may be dug, and roots are cut from the ground by horse-drawn machines —they must, however, be gathered into bundles or heaps, and ultimately removed by the help of manual labour. When stored they are threshed, and ground, and cut, and steamed by steam-driven engines, but they must be administered as food by manual labour.

There is one happy fact which Mr. Morton, by facts and figures, places altogether beyond doubt, viz., the introduction of steam-machinery for agricultural purposes, which has had the effect of benefiting the agricultural labourer, and not of injuring him, as many predicted. The explanation of this fact which Mr. Morton offers, and which seems to us to be the correct one, is this: that agriculture is more and more becoming the work of intelligence and skill as well as power—those parts of its processes where intelligence and skill are wanted, are becoming a larger portion of the whole. Cultivation is more perfectly performed, and over a greater extent of land—the crops cultivated require more labour and are more productive —the stock consuming them is proportionally larger and needs proportional attendance. But, whatever the explanation be, the fact is certain, as he says, that the use of steam-power on a farm is a part of that system which employs most labourers in agriculture. Mr. William Smith, of Woolston, who has an 8-horse engine for 110 acres of arable land and 70 acres of pasture, and works this engine only 14 days a year in cultivation, and not more in threshing, employs regularly throughout the year seven men and four boys, equal to nine men upon the whole, or one to every 12 acres of arable land and eight of grass—"more than any farmer in "the neighbourhood employs." His steam cultivation costs him on the average 10s. 10d. annually per acre on his clays, and 8s. 3d. annually per acre on his lighter soil. It has displaced exactly 2-5ths of the former horse-power; and he says that 70 per cent. of the cost of engine work is manual labour and only 30 per cent. engine food, while of the horse work displaced only 20 per cent. is manual labour and 80 per cent. is horse food. Mr. Morton accumulates a large mass of facts of a similar tendency. "Agriculture is, in fact, experiencing "the truth taught in the history of all other "manufactures—that machinery is, in the long "run, the best friend of the labourer. This "truth is taught even more impressively by a "review of agriculture generally, than it is by "the case of any individual farm."

The statistics which Mr. Morton has brought together to illustrate the extent to which agricultural machinery is coming into use are most impressive. He has had returns sent to him by all the leading manufacturers of steam-engines for agricultural purposes. Within the past ten years upwards of 40,000 horse-power has been added to the forces used in agriculture in steam alone. Messrs. Clayton and Shuttleworth of Lincoln, Garrett of Saxmundham, Hornsby of Grantham, Ransome of Ipswich, and Tuxford of Boston, alone are furnishing 10,000 horse-power annually to the farmer. Messrs. Tuxford—among the first to start the locomotive agricultural steam-engine—informed him that for the earliest suggestion of it they are indebted to Mr. John Morton, of Gloucestershire, then agent to the late Earl of Ducie, who twenty years ago recommended them to put these little engines upon wheels, thus foreseeing the fitness of these powers made locomotive to the circumstances of English agriculture. Messrs. Ransome, of Ipswich, were the earliest to receive the commendations and the prizes of the Agricultural Society of England for their engines, and now the leading manufacturers of them, Messrs. Clayton, of Lincoln, send out 10 of them each week, or 4,000 horse-power per annum. Of reapers, again, since 1851, Burgess and Key have sold upwards of 1,900 of their improved M'Cormick's reaper, of which 771 were sold last year; and they now hold four times as many orders as they did twelve months ago. Crosskill's have sold 500 of Bell's reaper, and 800 of Hussey's; Messrs. Dray have sold 800 of their improved Hussey's reaper; Messrs. Garrett have sold 600 of Hussey's; 250 of Wood's clever little reaper were sold last year, and the Cuthberts, of Bedale, who have just begun the manufacture of their equally clever machine, sold 100 before last harvest, and could have sold four times as many. In all, probably 4,000 reaping machines were at work last harvest, capable of cutting more in a day than 40,000 labouring men, and yet there never was such a harvest as the last for the difficulty of procuring harvest men. Yet, notwithstanding all this addition to the forces and the machinery of agriculture, more labourers than ever are required, and as more labourers are not forthcoming, wages rise, as Mr. Morton shows by an array of unquestionable facts.

THE CASE OF HENRY CORT,

AND

HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY

THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

XI.

"THE sanguine hopes" entertained by Mr. Dundas of Cort's inventions becoming productive were of course much heightened by the successful commencement, early in 1789, of the colossal forges and mills, which had been two years in progress at Cyfartha, Penydarran, Dowlais, &c., &c., under the superintendence and instruction of Henry Cort and his workmen, and the letters written to Cort by Sir Jeremiah Homfray, a man of honour (the predecessor of his brother, Samuel Homfray, in the management of the Penydarran), in Feb., 1789, and from Mr. Cockshutt, the resident and experienced managing partner at Cyfartha, describing the very successful commencement of Cort's process at all these works, and in which they had proceeded so well as to be able in the summer to take the Government contracts for iron, previously supplied from Cort's works at Fontley. Soon after (as ascertained by the Naval Commission), that is, on the 13th Aug., 1789, some proposals were made to Adam Jellicoe by the Treasurer and Paymaster respecting an extent upon Cort's premises for Jellicoe's default. But however unfortunately Jellicoe may have been led into appropriating public money, under a system which appears from his melancholy letter, and from the general inquiries of the Commissioners, to have been at that time the "official routine," yet he had the reputation of being otherwise an honourable character. He appears, therefore, to have felt deeply any proposal to ruin Henry Cort, whom he had deceived in common with others, who believed him to have large private property, out of which he was supposed to be finding money for the iron-works as a provision for his son. And it is very doubtful if Mr. Dundas could or would have dared to proceed to extreme measures while Adam Jellicoe lived. It was ascertained by the Commissioners that when Mr. Dundas required money he procured Mr. Jellicoe to draw cheques as if for naval service, and appropriated the proceeds to his private purposes. Two of these cheques were identified, one for £10,000 in 1782, during the first Treasurership of Mr. Dundas, and a second for £20,000 in 1785, during his next term of office. It is a singular coincidence, and it may be nothing more, that these two sums so nearly approach and cover the sum of £27,500, sworn to as the default of Jellicoe, for which Cort was made answerable; but nothing is more possible than that the advances to Cort were made by the principals of the office, who so well knew the value of the patents. However this may be, it is clear that Jellicoe could not easily have escaped ruin by recrimination. Mr. Dundas

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was in a position to have effectually stifled the recriminations of a defaulting subordinate; and it appears he continued to press upon Jellicoe the necessity of making good his deficiency, for on the 29th of August, sixteen days after the first proposal of an extent, an accountant was called in, and a schedule of Adam Jellicoe's effects drawn by him was found by the Commissioners, estimating the whole, including Cort's property, at £89,657. It should be particularly noticed that the patent contracts, which were considered to be of such value as to induce Mr. Dundas to countenance, as he states, the diversion of nearly £30,000 of public money upon "sanguine hopes" of their productiveness, and for securing which he anticipated a parliamentary reward, are set down at £100 only; so that the value of Jellicoe's estate was not swelled by any sanguine estimate on this head. The day after this schedule was made, Adam Jellicoe died by his own hand—a very singular circumstance, when coupled with his references to sudden death in the melancholy memorandum already stated. It is clear he would not countenance, and he could not live in the disgrace of witnessing, the execution of the nefarious designs of his superiors against his confiding and deceived friend. Mr. Trotter lost no time in a prolonged mourning for the decease of his senior, under whom, before 1782, he commenced his official career as a clerk at £50 a year, thence promoted by Mr. Dundas to be his useful Paymaster, over the head of an officer who had risen through forty-two years of service, and had been Deputy-Paymaster since 1777. On the 1st of Sept., only three days after the sad event, he performed the necessary swearing at a convenient distance from London, adding, to make the document complete, that Henry Cort—who was executing a contract with the Navy Board, from which the oath proceeded, for 450 tons of iron, value at the foreign price over £15,000, and upon which for what had been executed he held more than £4,000 of Navy Bills; and who in addition, as was equally well known to Mr. Trotter, had patent dues of £15,000 per annum coming in to him, without the least difficulty or dispute—"is, as he verily believes, much decayed in his credit, and in very embarrassed circumstances."

The premises at Fontley, Fareham, and Gosport, stock-in-trade, good-will, Navy bills, &c., &c., were valued at £39,452, and Samuel Jellicoe was put into possession of them by Mr. Trotter. In 1800, when this method of realizing public property for eleven years had left, as Lord Melville states in his memorial, £24,846 of Samuel's father's default unliquidated, out of effects valued at £89,657, the Treasurer's own default on quitting office that year, as nearly as could be estimated in 1803 by the Commissioners in the absence of documents, exceeded £193,000; and during the whole term of office he had retained yearly balances of public money averaging £600,000 for his private emolument.

It may even yet come to light how much he received as the price of not enforcing the patent contracts against the ironmasters. These patents and contracts disappeared, and have not yet been found. Where are they?

A return from the Navy Office of all iron supplied for naval service, and by whom, from 1782 to 1800 inclusive, will show who were the first to benefit by the ruin of Henry Cort.

In July, 1791, the following reply was received from the Navy Board to a letter addressed to it by Henry Cort:—

"SIR,—The Commissioners of the Navy have received your letter of the 4th instant, and I have it in charge from them to acquaint you that your invention appears of that utility as to induce them to give encouragement to the manufacture of British iron, performed according to the methods that have been practised by you.

"I am, Sir,
"Your most humble servant,
"JNO. MORRISON, Secretary.

"Mr. Cort, Devonshire-street, Queen's-square."

This condescending testimonial to a value that was undeniable is, indeed, a singular piece of cold-hearted equivocation and mockery. Mr. Cort's object was of course to call attention to his own claims. The Secretary reminds him that the methods which have been practised by him and others are now to be encouraged.

The ordinary device of setting up of the rival claims of others was a sufficient indication of the course intended to be pursued. The real point is evaded, and Mr. Cort is left to the hopeless task of fighting with interested officials backed by a public purse, and in possession of the patents, the only title by which he could enforce his legal rights.

In 1794, after three years more of such cruel and, under all the circumstances, infamous neglect, the following appeal was addressed to the Prime Minister, the Right Honourable Wm. Pitt:—

"SIR,—We take the liberty respectfully to state to you the unfortunate case of Mr. Henry Cort, late of Gosport, at which place he had, some time ago, iron contracts under Government, and among the rest a contract for making malleable iron with raw pit-coal only, and manufacturing the same by means of grooved rollers by a process of his own invention; we are sorry to add that, through the very great expenses necessarily attending the prosecution of these important instruments, this gentleman failed, when on the very eve of reaping the harvest of his patents, which were taken possession of under extents from the Crown.

"We have therefore been induced, not only from compassion, but from the good opinion we entertain of him, and from the great national benefits which now actually result from these his discoveries and improvements, to join with many others in a subscription to afford some temporary relief to him and his destitute family, consisting of his wife and twelve children, (nine of whom are wholly unprovided for, only one able to maintain himself). This, however, cannot possibly produce any other effect than merely to supply his present urgent necessities, without rescuing him from that state of poverty and ruin to which we are very sorry to find his meritorious exertions have reduced him; a circumstance which will appear the more unfortunate, when it is considered that the same pursuits have been attended with the greatest success and profit to others, who, availing themselves of his experience, have enjoyed all the advantages without encountering the labour and difficulties ever inseparable from the first practice of any new process.

"From these considerations we beg leave, Sir, to recommend Mr. Cort to your notice in the strongest manner we are able, as deserving of such encouragement from Government as may be thought most expedient, either by an appointment in some situation in one of His Majesty's Dockyards, the Customs, Excise, or any other office or place in which his talents and industry may prove useful to the public and himself. In any of which departments we will confidently engage that Mr. Cort's abilities and conduct will be such as by no means to discredit our recommendation, or any other countenance which you, Sir, may have the goodness to show him at our instance.

"We have the honour to be, &c., &c.,
SAM. THORNTON, M.P. } Russian
ROBT. THORNTON, M.P. } Merchants.
JOHN HUNTER, M.P.
Alderman L. MESURIER, M.P.
Alderman CURTIS, M.P.
Sir GEORGE JACKSON, Bart., M.P.
BROOK WATSON, M.P.
FRANCIS ANNESLEY, M.P.
GEORGE SMITH, M.P.
ROBERT SMITH, M.P.
Sir WATKIN LEWIS.
WILLIAM CHUTE.
J. J. ANGERSTEIN.
J. EWER.
J. & W. WILSON & SON."

(Mr. Brook Watson undertook to deliver this letter to Mr. Pitt.)

This appeal obtained Mr. Cort a pension of nominally £200 a-year, actual receipts about £150. It would have been more to the honour of the Minister to have restored to their owner his patents, then producing £25,000 a-year, than to tax the public purse even to the extent of this paltry pension. The impenetrable mysteries of office were not pierced by Mr. Henry Cort; he was ruined, but does not appear to have known why. The transactions of Messrs. Dundas and Trotter were very secret; sixteen years afterwards they burst like a thunder-clap on the public ear. Their contract with certain men to annul the patent claims had been snugly made, and the *quid pro quo* received, and the whole affair managed so cautiously, that the fact of H. Cort's ruin having been a great State secret has only recently been disclosed. A pension during pleasure was the best step to hinder disagreeable inquiries into the title of the son of a defaulter to all his possessions in Hampshire. In 1800 Cort, after witnessing the expiration of his second patent for rolling, died a memorable victim to official delinquency. £125 was then extended to his widow, net receipt £100, as stated in the petition to the iron trade. On her decease in 1816 pensions of £25 6s. each were granted to two unmarried daughters, subject to deduction, the amount of which is estimated at not less than £500.

The journals of the House of Commons record the following remarkable facts in connection with the foregoing—

"House of Commons,
Impeachment of Henry Viscount Melville,
1805,
Present, 433 Members, including the Speaker;
217 for Impeachment,
216 for Criminal Prosecution.
Extract from 6th Article.
Burning of Books and Papers.

"That during the time the said Alexander Trotter held and enjoyed the said office of Paymaster to the said Henry Lord Viscount Melville as aforesaid, and whilst the said Henry Lord Viscount Melville held and enjoyed the said office as Treasurer of the Navy as aforesaid, he the said Alexander Trotter kept with the said Henry Lord Viscount Melville an account current entered in certain books of account, containing entries of all the sums paid and received by the said Alexander Trotter in the account of the said Henry Lord Viscount Melville: and by agreement between the said Henry Lord Viscount Melville and the said Alexander Trotter, bearing date the 18th and 23rd February, 1803, it is stated that they had either mutually delivered up to each other, or resolved and agreed mutually to cancel or destroy, all the vouchers or other memorandums and writings that any time theretofore might have existed, passed, or been

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interchanged between them relative to the said accounts, and the different items and articles of which the said accounts were composed or constituted, and the said books of account containing the said account current, together with all vouchers, with other memorandums and writings in possession of the said Alexander Trotter, and also of the said Henry Lord Viscount Melville, relative thereto, were burnt or destroyed by the said Henry Lord Viscount Melville and Alexander Trotter; and the said stipulations contained in the said agreement for the said Henry Lord Viscount Melville mutually delivering up to each other, or for mutually concealing and destroying, all the said vouchers or other memorandums or writings relative to the said accounts was so entered into, and the said books and accounts, vouchers, and memorandums, and writings were so burnt and destroyed, with a view to conceal and prevent the discovery of the several advances of money made by the said Alexander Trotter to the said Henry Lord Viscount Melville, and of the several accounts and considerations for or upon which the sums were advanced."

The facts as stated in the above article were not disputed, but the conduct of Henry Lord Viscount Melville was declared by a majority of 88 over 47 Peers (the impeached commanding as it was supposed 40 proxies) not to be "a high crime and misdemeanour." The acts of the accessories to the transactions were declared to be inadvertent; the most glaring inconsistencies and forgetfulness occurred in the evidence of implicated parties.* The solicitor employed to issue the extent stated, that he did not consider it his duty to see that the annual payments from Cort's estate in the possession of his late partner Samuel Jellicoe were regularly discharged, conceiving that duty to rest with Mr. Trotter, who also excused himself on the plea of ignorance from all knowledge of the matters as to which he was interrogated.

Thus was Cort deprived of all his property; no one took any part in the matter, or could recollect what part they had taken or permitted to be taken; no one knew what had become of patents under which property to the amount of £200,000 might have been realized. Lord Melville, after having enjoyed possession for eleven years of freeholds and patents of ten times the value of the alleged default, obtains a further grant of £24,846 of public money after the death of Henry Cort, being discharged of this sum as the balance of the debt remaining due to the Crown by Cort and Jellicoe. The evidence of Samuel Jellicoe in 1803 is as follows:

"An extent was issued against the firm of Henry Cort and Samuel Jellicoe. Upon my being put solely in possession of the trade and effects, I engaged to pay all the debts of the firm, which I have done." If this be true, and no doubt it is, the trade being very lucrative, why were Cort's patents retained and withheld by the Treasurer from their rightful owner? The alleged default had been repaid twice over, once out of Cort's estate, and again to the amount of £24,846 out of the public taxes. The only actual result of this impeachment was, as usual, the punishment of the minor offender, Mr. Trotter being dismissed his office.

Well might Mr. Fox, in his speech on the 10th of April, 1805, remark, "The House may depend upon it the question will be a subject of consideration out of doors for a long period, and be agitated over and over again."

The present Marquis of Landsdowne, then Lord Henry Petty, was eloquent on the stigma affixed by these acts to the British Peerage.†

* See Report of Select Committee on the 10th Naval Report, May, 1805.

† See Journal and Debates of House of Commons and Lords.—Session 1805.

THE SMITHFIELD CLUB IMPLEMENT SHOW.

GREAT pressure upon our space has prevented our noticing in detail the exhibition of implements in the Smithfield Club Show until the issue of our present number, in which we shall endeavour to give a short but accurate statement of what few novelties presented themselves to us while examining this important although subsidiary portion of the long-looked for Christmas gathering together of cattle and implements, showing the progress of the preceding six months. In drawing attention, however, to what may be termed the novelties of the show, we labour under disadvantages unknown to those writing for the information or amusement of the general public, inasmuch as we unfortunately know that the greater part, if not the whole, of these "novelties" are no novelties at all, except in respect to the Show itself, and to some portion of those who visit it; the generality of the schemes having, in all probability, been before both us and our readers, at least upon paper, perhaps, for many months, and in some cases for years. Notwithstanding this, however, the appearance of an implement at the Smithfield Club Show is interesting even to those who knew of its previous existence, for it may be pretty generally assumed that it has, prior to its exhibition, known the test of experience to some extent at least, and has become one of the wants of the agriculturist. It is not easy at any time to invent an entirely new machine, or even to invent one which shall perform a similar operation to those already in use in an entirely new way; this latter is, however, very much more frequently accomplished than the former, although the utility of any great variety of machines for doing the same thing is somewhat questionable. At least it is quite certain that if three-fourths of the manufacturers of the almost endless varieties of root pulpers and chaff cutters of the present day were to receive forthwith a friendly "*advertisement*" or recommendation to desist from making their specialities, British agriculture would not be in quite a hopeless condition. Indeed, we feel sure that farmers in that case would save a vast deal of time now very unprofitably spent in ruminating upon what particular machine to buy. Besides the variety of machines for performing the same operation, there are also a great variety for differently treating the same substance. Take, for example, that favourite root the "sweed." Into what forms has it not been cut, torn, or ground? One machine slices it like pancakes, another cuts it into long square bars or fingers, a third makes it into veritable pills, and a fourth reduces it into shavings. Whether or not all these forms are absolutely necessary, in order to suit the more than epicurean tastes of fastidious swine, we cannot venture to say, but their production is sufficient evidence of the difficulty of anything new being done in turnip cutting. It may be that the difficulty of getting even pigs (whilst undergoing the finishing process for the Show) to eat at all when so required, has been so great as to have suggested the idea that in the event of a homely slice of turnip being refused, the offer of a delicate finger would be more acceptable; or failing this, a still more delicate pill or shaving would be irresistible. If this be so, these varieties of forms are doubtless highly scientific, though after all only suggestive of still greater refinements for the saving of unnecessary labour in the way of mastication. A machine could be devised for removing the sharp angles from the fingers before-alluded to, or one for fairly *smashing* turnips combined with a force pump might find favour, and would constitute the *multum in parvo* of pig-filling machines.

The greatest novelty of the show was perhaps Marriott's Canadian revolving harrow, manufactured by Samuelson, of Banbury. This implement consists of two or more separate systems of horizontal rings which continually revolve as they are drawn over the ground, thus relieving themselves from weeds, &c., and so lessening the power required to work them; the paths of the tines of these implements not travelling in parallel lines, but forming curves crossing one another, makes these machines more effectual than the common harrow. Few trials have as yet been made, but the arrangement is very ingenious and deserves fair testing. We next notice a new root pulper patented by Mr. Lambert and manufactured by the Trustees of Mr. Crosskill, of Beverley. These machines are made for hand and power, and consist of a cast iron cone, into which hooked knives are fitted which work against a ribbed fence. They are certainly very simple, and are said to pulp faster than any other machines, but this we cannot vouch for, and indeed we think it very unlikely to be the case. Messrs Goss and Peene's improved root grater also deserves special notice, although it has been out for, we believe, nearly three years, though never exhibited at the shows. It consists of a cast metal ring (which acts as a fly-wheel) having a flat plate attached to it with cutters formed therein in the usual way of this class of machine. It is very cheap and appears to be very effective. Romaine's patent portable railway, a model of which was exhibited, although not new, having been shown at Warwick, yet deserves a passing remark. In this apparatus each bearing wheel is made double, the two halves being fixed a few inches apart and having separate systems of shoes, as in Boydell's plan, but so arranged as that the *centre* of each shoe in one system should bear the weight when the ends of the shoes on the second system are in use. This prevents the ends getting embedded in the ground, and increases the bearing surface. Hornsby's patent plough also claims our attention here, although brought out at the Warwick meeting. These ploughs have the share, turnfurrow, or breast, attached to the slide or sole plate, instead of to the frame as usual. By this mode of construction the heavy handles and frame are solid pieces of wrought iron, very light and very strong. The draught of these implements appears very light, and seems to have astonished those who have witnessed them in operation.

Mulgrave Brothers, of Belfast, were new exhibitors in London, and showed an excellent assortment of railings, grates, stable fittings, wirework, standards for corn, rick stands, &c., all of which appeared of the best workmanship, and very moderate in price. Edward Palmer and Son, of Thetford, exhibited a new chaff engine in which the cutting blades, instead of being curved and attached to the arms of the fly wheel, are made quite straight, and attached to the fly-wheel shaft. These blades as they rotate pass a fixed cutter placed at the end of the feeding trough, and so cut the hay like a pair of shears; the revolving blades being fixed at an angle, the cutting commences at the lower ends, and progresses, as it were, along the edges. A machine with three knives, 15 inches long, has cut a truss of hay in less than two-and-a-half-minutes. Hancock's washing machine is comparatively a new machine, and consists of a case containing rollers carrying an endless band, upon which the clothes are laid, and upon which latter rest loose wooden rollers or discs, which are free to move both vertically or horizontally, so as to allow the clothes to pass under them. The only other matters we can notice are the brick-making machine of H. Clayton and Co., and the model of Fowler's steam-ploughing apparatus. The former, however, having been fully described in our pages a fortnight since, and Mr. Fowler's system some months ago, we need not now recapitulate what we have already said. Mr. Fowler is making good progress, as he deserves to do, in steam-ploughing, and publishes, with his present catalogue of prices, a very imposing list of testimonials of the advantages of using steam in place of horse-power, and the saving effected thereby.

With regard to the future site of the show, it appears that for the next two years little, if any, change can be made from the existing arrangements, but the committee are now earnestly at work seeking a fitting place to hold the Christmas shows, where ample space may be had for both

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cattle and implements. The corporation of the City of London would doubtless like the shows to be held in Smithfield itself; others, again, would locate them at Islington; some at the Crystal Palace, and some at Kensington. The general impression seems to be in favour of a movement westward, but we fear many objections will be made to the desecration of Kensington. How far ample space, good air and light, and, moreover, aristocratic "surroundings" might tend to improve the cattle show, we do not know, but unless about nine-tenths of the dirt and confusion at present experienced could be prevented, Kensington will be up in arms at the thought of bringing the Christmas shows there. There can be little doubt, however, that room exists for a suitable building which might answer for all sorts of flower, fruit, and poultry shows, as well as for a winter garden and the cattle shows, and no place seems better than Kensington for most, if not for all, of these purposes. With care and good management we think a cattle show would be endurable at Kensington, but care and good management would be absolutely necessary in order to make it so, and it will be well worth the committee's while, should they think of this site, to lay down their plans somewhat in detail in order to avoid needless opposition. The same building might also serve the purpose of the proposed exhibition of 1862, and any that may succeed it. It might also form an admirable place for rifle practice, and the annual gatherings contemplated by the Association for Promoting Rifle Corps, at which the promoters appear to hope as much as £10,000 a-year will be distributed in prizes.

ON THE WEIGHT AND STRENGTH OF AMERICAN SHIP-TIMBER.

By DONALD MCKAY, Ship-builder, of Boston, U.S.

WEIGHT OF A CUBIC FOOT OF

	Virginia White Oak.		Virginia Yell. Pine.*	
	Round.	Square.	Round.	Square.
	lbs.	lbs.	lbs.	lbs.
After felling...	64·74	67·20	47·81	39·21
1 Year after...	53·60	53·51	39·83	34·16
4 Years after.	45·97	49·89	34·28	33·49

Each of the above numbers are the mean of experiments on twelve different pieces of timber cut from different trees, and the experiments were made by Mr. Farris, Timber Inspector of Gosport Navy-yard.

WEIGHT OF A CUBIC FOOT OF LIVE OAK, ACCORDING TO GRIFFITH.

Green..... 78·69 lbs. | Seasoned..... 66·75 lbs.

This timber is exclusively used for the frames of the United States' men-of-war ships, and is considered by all naval men to be almost imperishable.

TENSILE STRENGTH OF AMERICAN WHITE OAK AND ENGLISH OAK PER ONE SQUARE INCH.

(*From "Appleton's Dictionary of Mechanics."*)

	lbs.	lbs.
English Oak	8820 to	10,224
American White Oak		11,501

SPECIFIC GRAVITY AND TRANSVERSE STRENGTH (PER ONE SQUARE INCH) OF ENGLISH OAK AND AMERICAN WHITE AND LIVE OAK.

(*According to Various Observers.*)

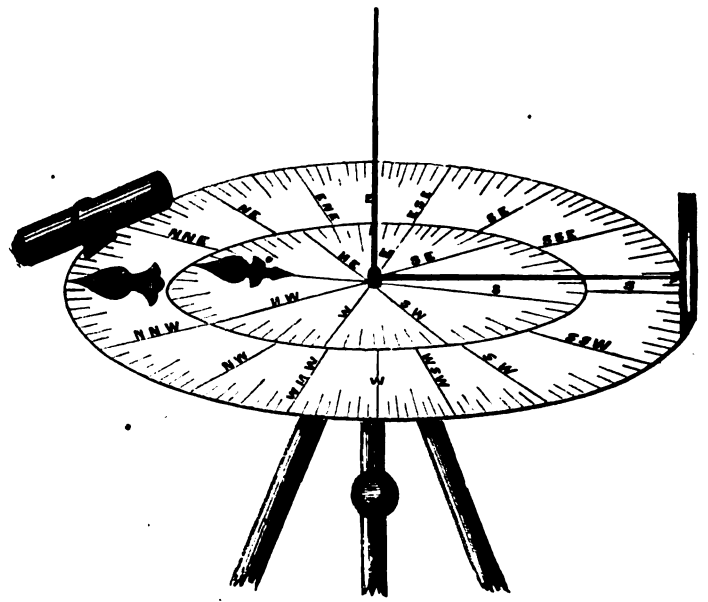
Extracted from a Table published in Vol. V. of the Professional Papers of the Royal Engineers.

Name of Observer.	English Oak.		American White Oak.		American Live Oak.	
	Sp.gr.	Strgh.	Sp.gr.	Strgh.*	Sp.gr.	Strgh.
		lb.		lbs.		lbs.
Lieut Nelson	834	1629	645	1699	1160	1862
Mr. Moore	816	1919	836	1699		
Mr. Barlow.....	934	1672	872	1766		
Lieut. Dennison ..	733	1556	772	1809		
Mean results ...	829	1694	781	1743	1160	1862

According to these experiments, the advantage of lightness, combined with strength, is entirely on the side of American White Oak.

* The Virginia Pitch Pine is called in America "Yellow Pine." The Florida Yellow Pine is called the "Long-leaf Yellow Pine," and weighs about 41 lbs. per cubic foot.

CAPTAIN TOOVEY'S AZIMUTH DIAL.



CAPTAIN SMALLMAN TOOVEY, of the mercantile marine—a gentleman who has had considerable experience in charge of iron ships, and well understands the necessity of testing the compasses of such vessels with all possible frequency and care—has introduced a valuable instrument for facilitating this operation. The accompanying engraving represents the improved instrument, which has already been employed on several voyages with the greatest satisfaction, and is now supplied to the navy by Messrs. Imray, Son, & Co. of the Minories. It is manufactured in cheap as well as high-priced forms, in order that no captain may have difficulty in obtaining it. The origin and nature of the instrument are as follows:—It occurred to Captain Toovey that it would be more convenient, when determining the error of the compass by the use of the dumb-card, if both the amount of error and its direction, *i. e.* the course by ship's head and the true course, were shown on the same card: he was thus led to adopt a modification of the dumb-card, which he calls the Azimuth Dial. The instrument consists of a double disc of metal (sometimes silvered), swinging freely on a tripod, and is of sufficient weight to be always horizontal, whatever may be the list of the ship. The outer rim of the disc is graduated to the points (or degrees) of the compass, and turning on the same centre is a second disc similarly graduated. There is a small pointer for indicating the direction of the ship's head: and it is also fitted with a style for obtaining the sun's shadow, but this can be removed, and the ordinary telescope and sight-vane applied in the usual mode of taking an azimuth of an object. The instrument is used thus:—By the use of Godfray's time azimuth chart, the true bearing of a celestial object can be determined at any moment, when its meridian distance is more than two hours and less than six hours. Thus, within those intervals, the points of the true horizon are known for any given instant. Having placed the azimuth dial in a convenient part of the ship for making an observation, fix the instrument so that the pointer may be on the line of the keel and towards the ship's head; set the inner and outer graduated disc so that their difference may show the amount of varintion as known at the place, such that the inner disc may indicate the true and the outer disc the magnetic horizon, then turn the dial on its axis until the shadow from the style on the inner disc coincides with the sun's true bearing at the time as given by Godfray's chart; the pointer will then also show the magnetic position of the ship's head on the outer graduated disc and the true on the inner disc. If the compass in the binnacle differs from the reading on the outer disc, the difference is the deviation of the compass on that point. In the same manner the error of the compass may be determined for any number of points. It can also be used to determine the error of the compass from the bearing of any distant object the correct position of which is known.

POOLE'S PARALLEL-MOTION SAFETY VALVE.

AFTER the meeting of the Institution of Civil Engineers, Nov., 22, Mr. John Poole exhibited and explained a "Parallel-Motion Safety Valve."

It was pointed out that the ordinary valve simply rested on its face or seat; its vertical or upward motion being guided by a spindle on the lower side passing through a box or feathers in the steam pipe. The area of the discharge pipe was thus reduced one-third, and in some cases as much as one-half. This valve was pressed upon by a weighted lever, moving on a hinge or centre on one side. When in a state of rest, the lever and the centre of the spindle were at right angles to each other; but as soon as the valve rose the angle became more acute. This brought an unequal load upon the valve, and caused friction, inducing a tendency in the spindle to twist and on the valve to jam or stick. The guide spindle, being below the valve face, was also liable to be corroded by foul or dirty water, and to unequal contraction and expansion. It was likewise found that these valves, when out of order, invariably leaked on the side nearest the hinge of the lever.

In the "Parallel-Motion Safety Valve" the spindle was on the upper side, the seat or face was flat, and the discharge pipe was free of interior incumbrances, so that less leverage and weight were necessary. The spindle passed through a guide above, and to the centre of the spindle, on which the valve was hinged, the parallel motion was attached. It was shown, by a sectional model, that the radial action of the lever did not control the vertical action of the valve, which therefore could not stick or jam in its seat.

LIST OF NEW BOOKS.

Bohn's Scientific Library, Morphy's Games of Chess, 5s.
Comstock's Manual of Natural Philosophy, edited by Hoblyn, new edit., 5s.
Dougall's The Rifle Simplified, 1s.
Hunt's Yachting Magazine, Vol. 8, 14s.
Lund's Geometrical Exercises, with Solutions, 2s. 6d.
Lunn's, Of Motion: an Elementary Treatise, 7s. 6d.
Potter's Physical Optics, Part 2, 7s. 6d.
Progressive Drawing Book, 2 Parts, 1s.

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Proceedings of Societies.

SOCIETY OF ARTS.

December 7th, 1859.—The fourth ordinary meeting of this session was held, J. Bennet Lawes, Esq., F.R.S., in the chair. Several candidates were balloted for and duly elected members. The paper read was "On the Forces used in Agriculture," by J. C. Morton, a lengthy notice of which appears on another page.

ROYAL GEOGRAPHICAL SOCIETY.

A numerously attended meeting of this society was held on Monday evening, at Burlington-house, Sir Roderick I. Murchison, Vice-President, in the Chair. Captain H. Godfrey-Austen, the Hon. and Rev. F. S. Grimston, F. W. Davis, M.D., R.N., H. Harwood Harwood, W. H. Purdon, and Francis Tagart, Esqs., were presented upon their election. Captain G. Augustus Bedford, R.N., Rear-Admiral Sir H. Byam Martin, K.C.B., Henry Ancell Edward Butler, Edmund Calvert, William C. Hood, M.D., Henry Raikes, M.A., Edward Smith, W. Castle Smith, Richard Todd, and James Watson, Esquires, were elected Fellows. Sir Andrew Agnew, Bart., M.P., Captain Claude Clerk, the Hon. W. H. Forester Denison, Captain J. Hamilton Ward, R.N., Edward Enfield, H. Hamilton Lindsay, Charles Otter, and J. Petherick, Vice-Consul at Khartum, Esquires, were proposed as candidates for election. The MS. trigonometrical survey of Kashmir, by Captain T. G. Montgomerie, F.R.G.S., under the direction of Lieutenant-Colonel A. Scott Waugh, F.R.G.S., Surveyor-General of India; sketches illustrative of Himalayan scenery, by Captain Austen and Mr. Purdon; Numerous sketches of scenery in British Columbia, including San Juan Island, &c., by Mr. Bedwell, R.N.; a map of the Fraser River, by Captain G. H. Richard, R.N., F.R.G.S., Her Majesty's Ship Plumper; a plan of the Tien-tsin-ho, showing the Chinese defences, by Major Fisher, R.E.; and a model of the largest gold nugget hitherto found, from Ballarat, by Professor Tennant, F.R.G.S., were exhibited to the meeting.

The papers read were:—

1. On the trigonometrical survey and physical configuration of the valley of Kashmir, by Mr. William Purdon, F.R.G.S., executive engineer, Punjab; communicated by Sir Charles Wood, F.R.G.S., India Office.

Prior to commencing the above paper, the Chairman read a letter from Lord Canning, expressing his approbation of the map of Kashmir, and alluding to the peculiar difficulties against which the officers of the survey had to contend, not only from the nature of the country itself but from the disposition of the inhabitants who were at that time strongly opposed to the British rule, and the men employed under the engineer officers were sepoys belonging to one of the regiments that had been first to revolt. Owing, however, to the skilful management and courageous conduct of Captain Montgomerie, the men had been retained in obedience and confirmed in their loyalty. The map which was the result of the survey was exhibited, and appeared to illustrate the description of the valley of Kashmir given Mr. Purdon's paper. The paper gave rise to a discussion, in which Colonel Everest, the former Surveyor-General of India, Captain Austen, of the Staff of the Great Trigonometrical Survey, and others, took part.

2. British Columbia. Journeys in the Districts bordering on the Fraser, Thompson, and Harrison Rivers. By Lieutenants Mayne, R.N., and Palmer, R.E., and Chief Justice M. Begbie. Communicated by the Duke of Newcastle, Colonial Office. —Lieutenant Mayne's report contains much interesting topographical information. It describes the character of the soil, the vegetation, and productions of the districts traversed, and points out the courses of the rivers and the general geographical features of the country. Lieutenant Palmer, in his paper, remarks that every miner admitted the existence of gold in the Upper Fraser River; and but for the scarcity and enormous price of provisions, there would be abundant work for those who were quitting the country. Dry diggings have yet to be found, which would be done when men possessed energy enough to prospect the country. But while provisions held such an enormous price, there could be no hope that any active exertions could be made. The Chief Justice Begbie, in his communication, observes that two chiefs, said to be of extensive authority, paid him a visit while at Cayoosh, and complained of the conduct of the citizens of the United States in preventing them from mining, in destroying and carrying away their root crops without compensation, and in laying wholly upon the Indians many depredations on cattle and horses, which, these Indians informed him were, in part at least, committed by Boston men. On the other hand, there were many cases of cattle stealing alleged by the whites of all nations against the Indians, and stealing of anything that could by possibility be eaten. The cattle which the Indians stole they did not attempt to sell or make use of otherwise than as food; and it was admitted on all hands that many hundreds of Indians had died of absolute starvation during the winter. The Indians said that the salmon had failed them now for three years together. The whites alleged what was obvious to everybody—that the Indians were extremely averse to work, except under the pressure of immediate hunger, and that they were so improvident as rarely to look beyond the wants of the day, or to provide for the winter. The Chief Justice expresses an opinion that this was more true of the savages who had never been brought into contact with civilisation than of those who had had even such a little acquaintance with the whites. He found almost everywhere Indians willing to labour hard for hire, and bargaining acutely for wages, and perfectly acquainted with gold dust and the minute weights for measuring one and two dollars with. These circumstances were inconsistent with an utter heedlessness for next day's provisions; for in all cases it was necessary to find these Indians in provisions as well as wages. The amount of wages for carrying burdens was 8s. per day, and provisions everywhere showed a high rate of profit as the wages of labour in British Columbia. If this was the average remuneration of the most unskilled labour, what would not skilled labour supported by capital earn? It was the uniform practice of those keepers to entrust these Indians with their goods, generally 100 lbs. of flour, beans, or pork, and provisions for their own subsistence. Thefts were said to be unknown, and great care taken of their burdens. The individuals who worked were found extremely fleshy and healthy. His impression of the Indian population was, that they had far more natural intelligence, honesty, and good manners than the lowest classes, such as the agricultural and mining population, of any European country he had ever visited, England included. At Cayoosh he tried to cause a grand jury to be summoned to present all these matters formally to him. But there were not twelve British subjects there. The Chief Justice says the chief points which struck him were, first, the ready submission of a foreign population to the declaration of the will of the executive, when expressed clearly and discreetly, however contrary to their wishes; secondly, the great preponderance of the California, or Californicised element of the population, and the paucity of British subjects; thirdly, the great riches, both auriferous and agricultural, of the country; fourthly, the great want of some fixity of tenure for agricultural purposes; and, fifthly, the absence of all means of communication, except by foaming torrents in canoes, or over goat tracks on foot, which rendered all the productions of the country, except such as, like gold, could be carried with great care in small weight and compass, practically valueless.

The Chairman, in proposing the thanks of the Society to His Grace the Duke of Newcastle for sending the papers, and also to those gentlemen who had prepared them, said that he was much struck with the fact that vessels of large tonnage could navigate all the rivers, thus affording access to the auriferous regions. He was glad to see young officers of the Navy employed in examining those distant regions of the British Empire.

MEETINGS FOR THE ENSUING WEEK.

MON.—*London Inst.*, "On the Radiation and Absorption of Heat," by Prof. John Tyndall, F.R.S., at 7 p.m.

WED.—*Society of Arts*, "On Starches; the Purposes for which they are Employed, and the Improvements in their Manufacture," by Mr. F. Crace Calvert, F.R.S., at 8 p.m.

London Inst., Soiree.

THU.—*Royal Society*, at 8 p.m.

FRI.—*London Inst.*, "On Certain Principles of Vegetable and Animal Chemistry," by F. A. Malone, Esq., F.C.S., at 7 p.m.

GRAVELEY'S PATENT IMPROVED DISTILLING AND COOKING APPARATUSES.

DISTILLING and cooking apparatuses for use on board ship are now so universally in request that their manufacture has become a matter of much importance to shipowners. We are anxious, therefore, to place before our readers a set of apparatuses recently devised by Mr. Graveley, of the well-known firm of Winchester and Co., Upper East Smithfield, manufacturers of ship fire-hearths, &c., for the marine of this and other countries. Mr. Graveley and the firm mentioned have had the advantage of very great experience in connection with this subject, and have introduced apparatuses for distilling and cooking which certainly are not surpassed, to say the least, by any others. Those supplied by them for the Great Eastern, the General Admiral (Russian frigate), and other important vessels, many of them men-of-war, are among the best examples of this class of articles to be found on shipboard.

Their latest improvements, which we now propose to illustrate and describe, have done a very great deal towards perfecting apparatuses for distilling and cooking on board ship, leaving little to be desired in respect of either efficiency, economy, or compactness. The first apparatus which we shall describe consists of a furnace with the ordinary appliances for cooking, roasting, and baking, and of one or two steam boilers arranged and acting as hereafter described. The same fuel and furnace perform all the operations. One boiler is similar to an ordinary tubular boiler; the patentee divides the steam chest or dome into two compartments by a partially perforated plate to prevent any undue pressure of steam coming too suddenly in contact with the steam-pipe leading from the dome. Inside the lower compartment he places a small dome perforated to a given height up the sides. Inside this small dome is a globular valve provided with a proper seating, into which seating a pipe opens. This pipe is intended to carry off any salt water that may arise with the steam; the globular valve is enclosed to ensure its not being held down on its seat by the pressure of the steam in the chest.

He encases the above-named steam-boiler in an air tube to prevent loss of heat by radiation, and outside of the air tube is fixed another boiler containing a quantity of tubes in connection with steam-pipes from the chest of the internal boiler for the purpose of boiling sea water. Atmospheric air is admitted to aerate and mix with the steam from the first steam-chest after the same has entered the tubes in the second boiler, and force or drive in the air by a jet of steam. On the second boiler is another steam chest or dome divided into two compartments and fitted with a globular valve as in the dome first mentioned. A steam-pipe leads from the top of this dome, and an orifice is made in the side of the dome for the admission of atmospheric air, and introduces a jet of steam from the first-named steam-chest to draw the air in. The steam-pipe from the last-named dome leads to a small cistern or box containing fresh water, in which the steam from both the boilers is first received and becomes condensed. The water from this box then passes through a condenser and filter in connection with it, and is discharged from the filter in the state of pure

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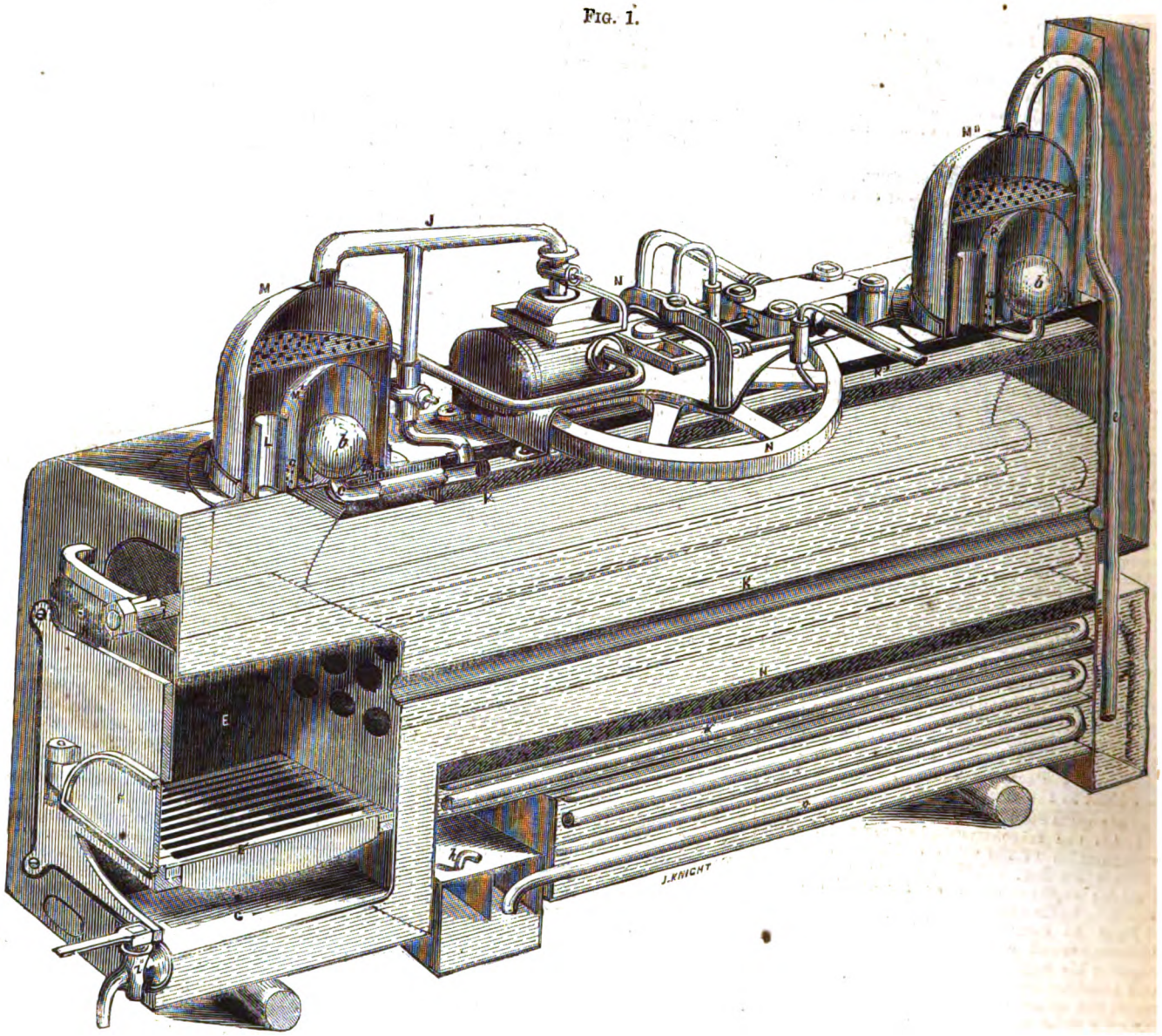
GRAVELEY'S PATENT IMPROVED DISTILLING AND COOKING APPARATUSES.

FIG. 1.



aërated fresh water. On the outer case a pumping engine is fixed for the purpose of keeping a constant supply of cold sea water to the condenser, and for feeding warm salt water from the condenser to the boilers. The pumping engine is worked by steam from the steam-chest first described. A pipe is connected to the outer boiler, rising to the water line to allow of a constant discharge of brine to prevent incrustation. The flues after leaving the boiler tubes pass round or against an oven, in order to utilise the heat which would otherwise be lost.

Fig. 1 of the accompanying engravings is an isometrical perspective view, partly in section, of an apparatus for cooking, roasting, and baking, and for purifying and aërating sea water, constructed according to this invention. This apparatus is a very convenient one for transport to foreign parts as a land apparatus, occasioning no trouble when at its destination, because it is packed for transport without being taken to pieces or interfered with in any way. It may even be mounted on wheels and drawn, if required, from place to place. *E* is the fireplace, *E*¹ are the furnace bars, *F* is the furnace door, *G* is the ashpit. *K* is an ordinary tubular boiler, which is surrounded by an air tube or by a thick packing or felt *H* as shown; *K*¹ is another boiler which surrounds or encases the felt and tubular boiler *K*. *M* is a dome or steam-chest, which is fitted to the boiler *K* and receives the steam generated therein through a pipe *L*. *I* is a perforated plate placed near the upper part of the dome; *J* is a steam-pipe for the passage of steam to drive the engine *N*, which is fixed on the upper part of the whole apparatus and is intended to keep up a constant supply of sea water to the boilers *K* and *K*¹ and to the condenser. *M*¹ is another and smaller dome placed in the interior and at the lower part of the larger one. It is perforated at its lower part at *a a*, through which perforations steam and any salt water that may rise with it enter the small dome *M*¹; *b* is a globular valve, into the seating of which a pipe *c* enters which curries off the salt water just mentioned to the boiler *K*¹. *M*" is another dome or steam chest similar to that just described, it also contains a perforated plate *I*¹, an internal dome *P* which is perforated as before, and globular valve *b*; *c* is a pipe fitted to the upper part of the dome *M*', through which steam passes to be condensed. This pipe *c* leads into a water cistern *f* in communication with a refrigerator *g*, which is surrounded by cold water. The condensed steam circulates through the pipes of the refrigerator and finally enters a filter, from which it is drawn off pure water by a pipe furnished with a tap. Atmospheric air is drawn into the dome *M*" for the purpose of aërating the water through another pipe, but which enters the side of the said dome. A jet of steam is admitted into this pipe in a downward direction through a pipe leading from the dome *M*, for the purpose of creating a draught of the air. The products of combustion after passing through the flues of the tubular boiler pass off to the chimney; *i* is a brine cock for discharging water from the boiler.

A modification of the apparatus last described is illustrated in the isometrical perspective engraving Fig. 2, in which a single boiler only is used, and the arrangement of the parts is altered; the method of action, however, in order to obtain pure aërated fresh water from sea water, is in both cases the same. Fig. 3 is a longitudinal section of the same, and Fig. 4 is an end view; *E* is the fireplace; *E*' *E*' are the furnaces; *F*' is the furnace door; *G* is a hot-plate for stewing; *H H* are guard-rails fitted round the hot plate. Bars or

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FIG. 2.

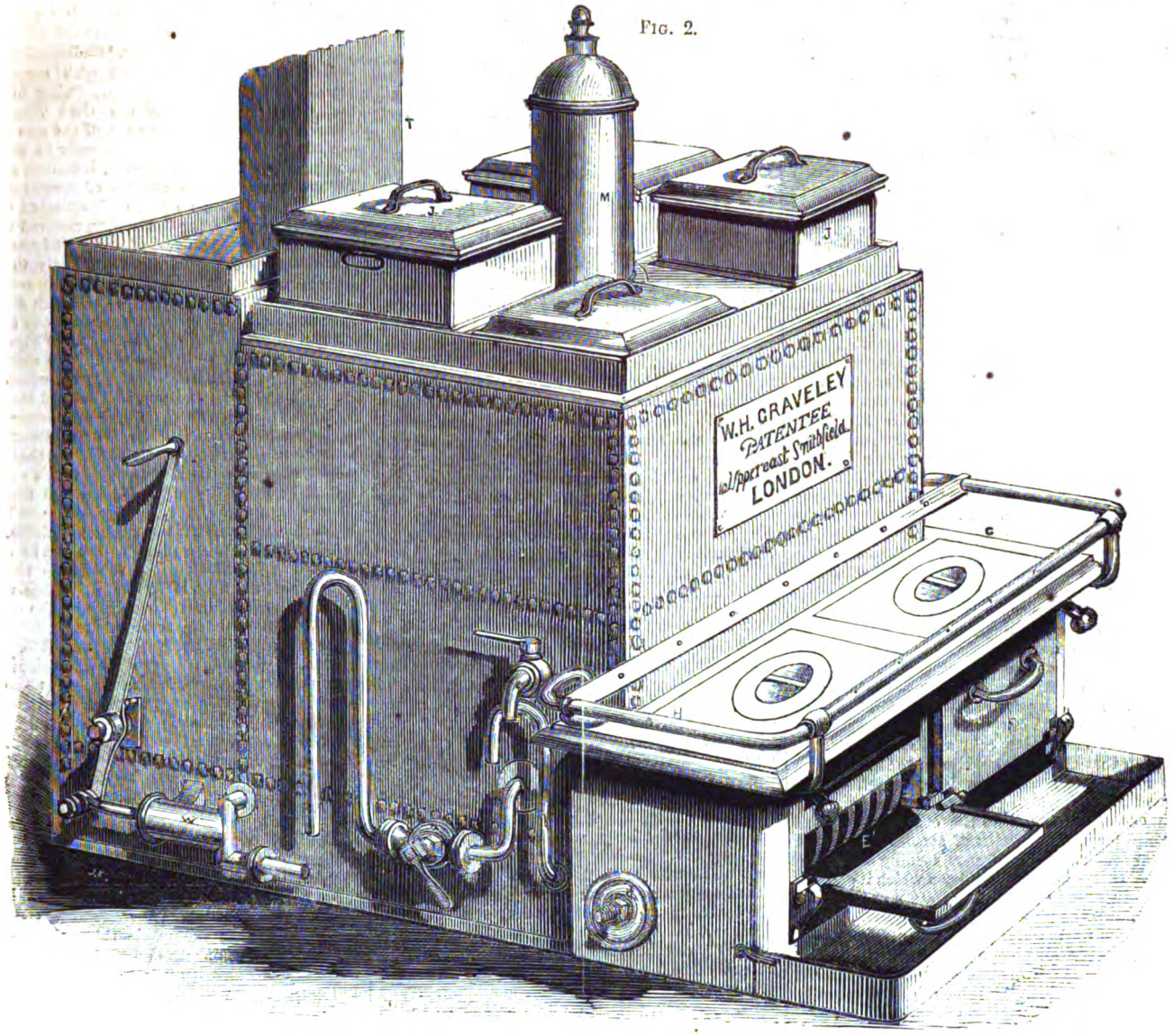


FIG. 3.

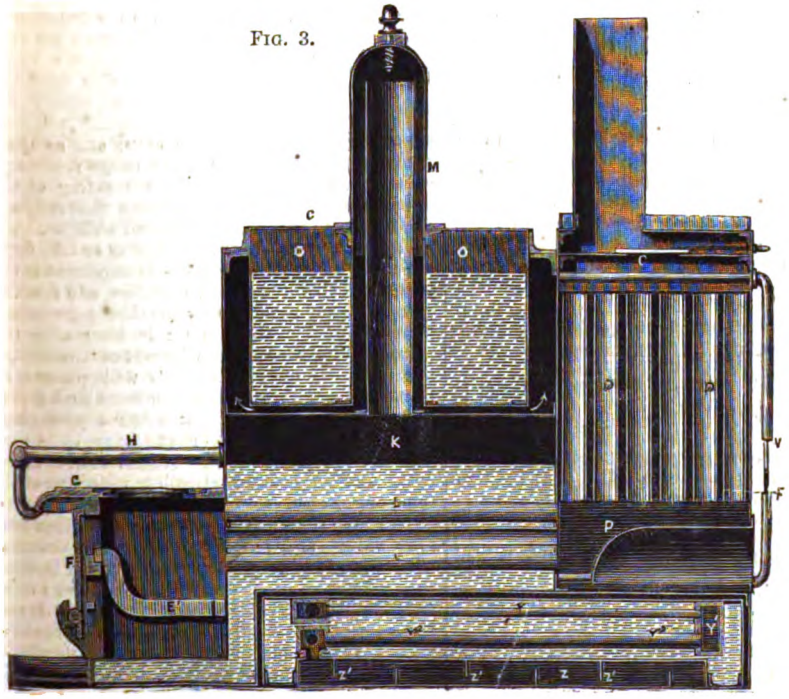
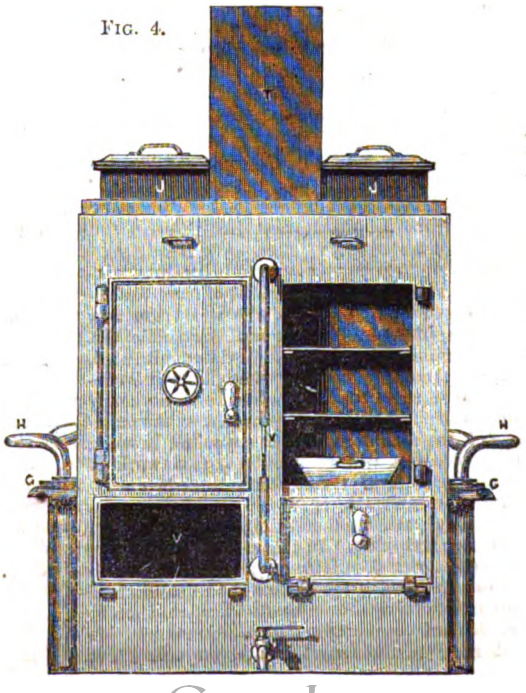


FIG. 4.



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rails are fitted to the guard which are intended to support saucepans or other cooking utensils, and to prevent them from rolling off or shifting. *J J* are steamers of the ordinary construction fitted or placed at the top of the apparatus; *K* is a boiler the water in which is heated by the products of combustion passing through flues *L L*. *M* is a dome at the upper part of which a safety valve is fitted, and which has a tube placed inside the dome and extending to nearly the top thereof. The steam which is generated in the boiler passes up this tube and decends between the tube and the dome *M*, surrounding the cooking boilers *O O* (as indicated by the arrows). The flues *L L* are in communication with a smoke box *P*, through which the products of combustion pass to the vertical tubes *Q Q* which surround the baking ovens shown in Fig. 4. *C* is a division plate and damper, and *T* is a chimney. *V* is a hot closet heated by the products of combustion as they pass from the flues *L L* to the tubes *Q Q*. *V'* is a gauge to indicate the height of the water in the boiler. *W* is a hand pump shown in Fig. 2 by which salt water is forced into the boiler; or instead of a hand pump a donkey engine may be employed. Steam is led through a pipe from the boiler *K* to a refrigerator or condenser placed at or near the lower part of the apparatus. *A* cock is fitted to the upper part of the steam pipe, which regulates the pressure or quantity of steam allowed to circulate round the cooking boilers. The condensed steam after entering the refrigerator traverses the pipes *Y Y*, enters a compartment *Y''*, and passes from thence to other pipes *Y''' Y''*, after traversing which it enters a filter *Z* which is provided with partitions *Z' Z'*, so arranged that the water may pass through an extended surface of the filtering medium. A pipe is provided by which pure fresh water is drawn off. The space round the refrigerating tubes is filled with cold salt water, and the partition that divides the water in the boiler from that round the refrigerator is composed of felt encased in iron, which prevents any heat passing from one compartment to the other. A pipe is provided for the admission of atmospheric air to the condenser. A small pipe leading from the boiler *K* enters the air pipe, down which it extends a short distance in order to create a draught for the air down the pipe *W*. *a* is a feed cock to the boiler and a waste water cock from the condenser, *b* is a discharge air pipe, *c* is a tap by which hot distilled water is drawn off. *d d* are mud holes, *f* is a brine cock by which the brine can be constantly withdrawn, and incrustation of the boiler thereby to a great extent prevented.

We have taken pains to inquire into the working of these apparatuses as designed by Mr. Graveley and manufactured by Messrs. Winchester and Co., and we find they have given great satisfaction to owners. They are cheaply made, easy to work, and will run for several voyages without requiring any repairs worth mentioning. While, therefore, costly and uncertain apparatuses are constantly being forced upon the notice of shipowners, we cannot fail to bring the merits of these more economical and efficient ones to their attention.

THE TASMANIAN SUBMARINE CABLE.

THE first submarine electric cable of any considerable length in this part of the world has now been successfully laid and opened for public use. The 120 miles of Bass's Straits is thus annihilated, so far as the communication of intelligence is concerned, and the island of Tasmania is for many important purposes as closely united to the mainland of Australia as though no sea rolled between them. This, it will be admitted, is a work of some magnitude for these colonies, and is creditable to the enterprise of Victoria and Tasmania, who have themselves found the whole of the funds for the undertaking. In this case the object to be gained is worth even some annual expenditure in excess of returns, if the line cannot be maintained without it; for their can be no question that to Tasmania the advantage of instant communication with these colonies must be very great. The annual trade transactions between that island and the mainland are stated by the Launceston papers to be now represented by a sum amounting to more than £1,000,000 sterling, and, as the markets of the one colony are entirely regulated by those of the others, it cannot be otherwise than a matter of deep importance that a close intercommunication should exist between them. One chief source of risk and expense said to be connected with this line is, that it has been laid in four separate sections—first from the north side of the King's Island to Cape Otway on the Australian coast, then in the opposite direction from King's Island to Hummock's Island, thence to Circular Head on the north coast of Tasmania, and from that point along the coast to the entrance of the Tamar, where it joins the land line to Launceston and Hobart Town. From this arrangement the shore-ends of the cable are numerous, and all of them are said to be considerably exposed to injury from the nature of the places at which the landings have been made. Under those circumstances it is being urged upon the Governments of Victoria and Tasmania that they should at once incur the additional expense of procuring from England sufficient surplus cable to make good any injury which either of the four sections may sustain; and this, we think, is a very reasonable suggestion, seeing how many chances of accident the line is exposed to.—*Australian Mail.*

HADLOW'S LINEN MARKER.

THE marking of linen is an operation which is often performed badly, and often neglected altogether for want of a convenient mode of executing it neatly and easily. Observing this, Mr. F. V. Hadlow, of Prince Albert-street, Brighton, has contrived and obtained a patent for a simple little arrangement of apparatus by aid of which we may henceforth get rid of all difficulty in the matter.

It is a neat combination of a relief engraved box-wood stamp, bearing the name, &c., to be placed upon the linen with a supply of Bond's marking ink, the whole being contained in a small case. This case (of birch-wood) is turned in three pieces, screwing together for opening and closing. The central portion contains a very small bottle of fluid marking ink and the engraved marker, just large enough to hold firmly between the thumb and fingers. The top division, in the form of a deep hollow cap, with an ornamental moulding, screws down upon this, whilst the base screws on to the bottom of the central piece, and serves as the receptacle for an india-rubber disc, with a black cloth disc over it. On the base or lower face of the central piece there is attached a code of directions for use, so as to be ever at hand, and most conveniently accessible. All that is necessary is to spread a drop of ink upon the cloth disc resting upon its india-rubber base, press the face of the marker upon it, and then apply it to the linen to be marked. When warmed subsequently by an iron the impression comes out clear, black, and indelible. The same apparatus answers for paper and other surfaces. If little ink is used, the markings are very sharp—quite different to the blurred hieroglyphics usually met with. The arrangement is so convenient and effective, that all who have frequent necessity for marking names, numbers, or addresses, must find it extremely useful.

The Duncan, 101 guns, has been launched at Portsmouth. A 51-gun frigate, to be named the Dryad, is to be immediately laid down under the shed vacated by the Duncan.

Paris papers state that the French Government has ordered the systematic gathering of seaweed from the rocks of Normandy and Brittany, to serve as wadding for artillery, for which purpose it serves admirably.

Among new inventions attracting notice is one called the Patent Adamas, a silicious composition, alleged to be free from liability to corrosion or oxydation or destruction from heat or acids, and which is said to be in a course of trial by some of the gas companies as a material for burners, which will save them the expense of constant renewals.

THE CORT TESTIMONIAL FUND.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Manchester, 14th December, 1859.

GENTLEMEN,—I have read with surprise an article in your Magazine complaining in bitter terms of the conduct of the Cort Testimonial Fund Committee. The aspect of the case as presented by you is calculated seriously to prejudice the interests of the Cort family, inasmuch as it reflects discredit upon a number of gentlemen who met only five weeks since, and, actuated by the utmost sympathy for the family, resolved upon a course which, to the best of their judgment and knowledge of the case, was most likely to secure the end they wished to attain. They proved their liberality by subscribing £260, of which £30 was given to Mr. Cort; and to a man in needy circumstances this could not be, nor ought to have been, a sum received with ingratitude. The committee passed the resolution quoted by you, which it is my duty to see carried out, and beyond that resolution it is impossible to go without another meeting being held to rescind it. So far, about £530 have been subscribed, and it was hoped that £2000 would soon have been obtained; which sum invested in annuities, (after placing the family in circumstances free from debt,) would have been a comfortable yearly income to the recipients. No public movement, as you are aware, can be carried through without affording reasonable time for working it, and that is all the committee require in this case. A few weeks more, and the committee hope to conclude their honorary labours, if their appeal be but promptly responded to. Allow me to beg you will not again by injudicious statements damp the generous ardour of those who have taken up this case, much less attempt to question the justice or benevolence of such men as those who at once and so nobly responded to the claims of genius, or age and infirmity. I am, &c.

DAVID MORRIS.

[We must take the liberty of telling Mr. Morris that we esteem the above both a very foolish and a very impertinent letter—especially the last part of it. What have we said to "damp the generous ardour of those who have taken up this case," or to "question the justice or benevolence of such men," &c.? Did we not expressly say, that the whole thing to which we objected was "doubtless an oversight," and that we gave Mr. Fairbairn "ample credit for meaning and purposing well?" We would inform Mr. Morris—who is but a novice in reference to the Cort case—that by several years of well-considered advocacy of this case we have earned the right to offer a suggestion, and even to administer a rebuke, when other friends of the cause are committing great and palpable errors. We would further tell him, and our readers also (although the latter will have foreseen it) that some of the old and tried friends of the Cort family, and some members of the committee even, are as much astonished as ourselves at the strange resolutions passed at the late Manchester meeting of the committee, and are wondering why the family are not instantly relieved from their liabilities. We have nothing to add to, and nothing to take from, our last week's remarks on the management of the committee. We will only, therefore, add that the past history of the Cort case has demonstrated the strong necessity there is for looking after the money contributed for the benefit of the family; and no anger of Mr. Morris's will prevent us from seeing either that the present fund is properly administered, or that those (if any) who may attempt to misapply it shall have their proceedings brought to light. If Mr. Morris writes to us again on this question, he must amend his tone, or we shall feel bound to enter with greater minuteness than before into the proceedings that have taken and are taking place in connection with the Manchester Fund. All we ask is, that the money subscribed shall be applied to its legitimate object without delay, and we do not believe the committee desire to keep it locked up from the poor and extremely aged people.—EDS. *M.M.*]

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STEAM-SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

GENTLEMEN,—It is very probable, as Mr. Atherton says, "that it is rather a trial of one's patience to repeat explanations in matters of theoretical investigation," but the greater trial of patience to which, notwithstanding, I would again respectfully invite him, is to give an answer to the objections urged against these same explanations, or else to admit their validity. In the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h. p.}}$ the objection to the $\frac{2}{3}$ power of displacement is, that in the case of vessels which are not of the same form or type of build, it is not identical in value with the midship section, and is therefore erroneously employed instead of it; and that in the case of vessels which are of the same type, and where of course it is admitted that there is a virtual identity in these two expressions, the formula embodying either affords no information concerning the comparative merits of steam-ships as marine constructions, either in point of velocity alone, or in conjunction with carrying capacity. How can it, when they are all alike, except in size? The co-efficient set up for a standard would be common to all, apart from the influence of size. The formula might give some information concerning the comparative efficiency of propellers, but Mr. Atherton repudiates any utility in this direction, by assuming that practically it may be considered to have a constant ratio to the power. The formula affords no information concerning the comparative resultant efficiency of the several means employed in the production of power, for it accepts it as already provided, and as declared by the indicator. What then remains to be determined? and which the co-efficient of performance can in a comparative view be supposed to indicate? Nothing as I can see, except the influence of size, in which item there is no variety, nor any scope for the exercise of skill which can, like form, be tested in this way. Such influence can result only from a diminished ratio of water friction accompanying an increase of displacement under the same type. Now, it would be very desirable to ascertain the rate of augmentation of useful effect, by this diminution of the useless effect; but being once determined for the type, what permanent utility would the formula be to merchants? And yet this is its ostensible purpose.

When, indeed, the weight of coals burnt per hour is substituted for the indicated horse-power as the denominator in this formula, we do obtain some information on steam-ship economy, in the coal-consuming, though not in the building department; but the duty done per ton of coals could be ascertained more directly, and in a much better manner, if the performance was registered as declared by the indicator, or by a dynamometer; because the influence of all extraneous circumstances would be eliminated, and because neither time nor velocity, which indeed do not belong to it, would be implicated in the estimate of duty. And this leads me to say, that for vessels of the same type, and not differing greatly in size, any difference in the co-efficients of performance observed in practice by application of the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{wt. of coal.}}$ must be explained as the result of differences in furnaces, fuel, and firing. This *modification* of the formula may have a certain utility if confined to vessels of the same type, provided we are given to understand what is truly indicated by it, and that we are not informed that "the fact of inferiority being established, the type of form of the hull, with the condition, construction, or management of the boilers and machinery," are equally points where "the fault may be," and that "under this scrutiny all bad types of form will be eradicated." Whence could arise the illusion that the type is the subject of ordeal, when it is so sedulously impressed upon us that the type is a given element in the question? It is the vessels ranking under each type which are tested, and they only in reference to one fault, that I am aware of, which is, the foulness of their bottoms. All else refers to boilers, engines, and propellers. Velocity is the natural, as it is the only test of a ship's form, and of the cleanly or dirty state of her skin; but it is very unnecessarily, and in a very round-about way, a test of anything besides.

We now come to the case of vessels of different types: here the comparative worth of the form is fairly the point at issue, that is, the types themselves are on trial, and therefore we must have a test or formula which is applicable to them all. This is in fact saying, that it must apply to vessels in common, without any classification into types at all, at least as a point of necessity. But here the $\frac{2}{3}$ power of displacement is a misleading quantity, because it is no longer identical in value with the midship section. Now, according to Mr. Atherton's own admission, this section is the true basis of any formula; and so it is if velocity be the sole useful effect to be inquired into; but for some reason which I cannot conceive, he chooses to express it in terms of displacement. If, however, we do so in this case, where such expression is erroneous, both as a substitute for the other and for its own demerits besides, the comparative results of steam-ship performances so ascertained cannot be otherwise than false. So then, in fine, for vessels all of one type the formula is useless, and for those of different types worse than worthless.

The midship section formula is appropriate for velocity, but to represent the comparative worth of vessels in the aspect of velocity and carrying capacity conjointly, we must, I repeat, make the simple displacement the basis of the formula. With the use of either it will not be necessary to class vessels according to their type. No such classification is imperatively required with the Cornish steam-engines, in order to estimate and register the duty done by them; nor would it even be useful, except as between pumping engines and crank engines, where the difference is too great for a fair comparison. All other minor diversities of construction go themselves as influencing circumstances into the estimate of performance, along with boilers and modes of stoking. In steam-ships it would also be *useful* to divide them into transport and passenger vessels, but without needing any very exact line of demarcation. Either formula would apply to each class, but that based on the simple displacement would be more peculiarly appropriate to the former, and the one based on the midship section to the latter.

Mr. Atherton applies the word "duty" to a dynamic performance in which velocity is an element. It is really undesirable that mathematicians should take up with words of practical origin, and expressive of practical but yet scientific, though not at the time mathematical ideas, and make them include what was not at first intended. "Work" and now "duty" are invested with time and velocity, although originally expressive of power measured by space alone. Mechanical power and mechanical effect were the terms employed, when the idea of time was involved.

Yours, &c. BENJAMIN CHEVERTON.

Law Cases.

FIELDEN'S PATENT COPS.

COURT OF QUEEN'S BENCH, DEC. 13.—(*Sittings at Nisi Prius, before Lord Chief Justice Cockburn and a Special Jury.*)

FIELDEN *v.* LORD AND OTHERS.

Mr. Wilde and Mr. Hindmarch appeared for the plaintiff, and Sir F. Kelly, Mr. M. Smith, and Mr. Aston for the defendants. The plaintiff, a workman employed in a cotton-mill, brought this action against a mill-owner for an infringement of his patent for improvements in the construction and building of cops, and the defendants alleged that one Enoch Fielden was the true and first inventor, and that the plaintiff obtained his patent by fraudulent representations. A cop is the cotton wound off on the spindle in a conical shape at the ends, having a hole throughout, as in an ordinary cotton-reel, caused by the spindle, and used in placing the cop on the shuttle. In practice it was found that a great deal of cotton was wasted by the bottoms of the cops being "britted" while being taken from the mules in baskets to the machinery for the next process of manufacture. To obviate the difficulty, gutta-percha foundations for the cops were used; but a more complete remedy was discovered in running a brush of paste along the mules, so as to coat the bottoms of the cops and render them less liable to injury. John Fielden, the plaintiff, and Enoch Fielden were friends, and, in a conversation one Sunday afternoon, the latter suggested that paste would do. John Fielden experimented and took out a patent first. Enoch Fielding stated that before the conversation he had experimented and tested by success the value of his invention. He also took out a patent, and Messrs. Lord defended this action, relying upon Enoch Fielding being the first inventor.

The case commenced yesterday, and occupied the greater part of to-day, terminating in a verdict for the defendants.

OXLEY'S PATENT HINGES, ETC.

COURT OF COMMON PLEAS (*second court*), DEC. 13.

OXLEY *v.* HOLDEN.

This was an action to recover £50, being the amount claimed for royalty upon the sale of certain hinges, elastic cushions, and studs and plates intended to be used in the windows and doors of railway carriages, the object of which was to prevent the noise and jarring usual when trains are in motion. The plaintiff, who claimed to be the inventor of the above articles, had entered into an agreement with the defendant, whereby the latter was permitted to manufacture and sell them, paying upon each a royalty of 4d., it being further stipulated that the plaintiff should be paid at all events £100 per annum by four equal quarterly payments. There were pleas negativing the novelty of the alleged inventions, and that the defendant was induced to enter into the agreement by the fraud and misrepresentation of the plaintiff.

The jury found a verdict on both issues for the plaintiff.

Mr. Wordsworth, Q.C., and Mr. Henry James appeared for the plaintiff, and Mr. Serjeant Shee, Mr. Hindmarch, Mr. Keane, and Mr. Griffiths for the defendant.

Our Weekly Gossip.

THE Admiralty have decided upon building two new iron frigates in addition to those now in course of construction by the Thames Iron Shipbuilding Company and Messrs. Napier of Glasgow. The new frigates are to be of a similar construction to those already in progress, but of smaller dimensions. Contracts for them have just been taken, one by Messrs. Palmer, of Jarrow, and the other by Messrs. Westwood and Baillie, of Millwall. It may be well to state that the two new frigates are designed exclusively for home defence.

The Queen has granted a pension of £150 a-year out of the civil list pensions to the daughters of Henry Cort, whose inventions in the manufacture of iron have contributed so much to the prosperity of the trade, while his family have been left in deep distress. The Queen has also been pleased to grant a pension on the civil list of £125 a-year to the sisters of the late Dr. Dionysius Lardner, whose contributions to science are so well known.

It is a singular fact, and one which illustrates the dependence of trades of almost every kind upon the eccentricities of the devotees of fashion, that since the extensive use of crinoline in England, the wire-drawers, and a considerable section of the wire-workers of the kingdom, have been exceedingly busy, and are at this moment obtaining very high wages! It is not easy at once to comprehend the cause of this phenomenon, or to trace the connection between crinoline and brass wire, but a little reflection makes the matter clear. The wearers of crinoline, from the amplitude of their costume and the consequent difficulty of calculating distances, are more exposed in their homes to danger from fire than are those other ladies whose dresses project little beyond the limits assigned by nature to their fair forms. Hence the

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necessity for extra-precaution in the shape of wire fire-guards—hence the pressure on the wire-trade—hence the high rate of wages referred to. It is satisfactory to observe, too, that an impulse has been given to *art* as well as to labour in the matter of fire-guards. All will remember the primitive nature of those articles as hitherto used in nurseries, &c., but now that they are required for the protection of "grown-up children," and have to figure "before company," it has been found desirable to vary their forms, materials, and prices, and to impart "style" and taste into their construction. They are at present used in West-end drawing-rooms, as well as in humbler parlours, and must be made consonant, therefore, with the neighbouring furniture, the fitments of the refracting and ornamental stoves, and the richly ornamented fenders. If this were not so they would be pronounced "de-ci-dedly vul-gar," and, despite their preservative value during the mazy dance, a "horrid baw." We have seen some elegant specimens of modern fire-guards, and we know that several firms in London are overburdened with orders for them "to be supplied immediately and regardless of cost." Well may the workers referred to rejoice in the prevalent fashion, and loudly exclaim, "*Vivat crinoline.*"

The following letter suggests an important consideration or two:—

London, 12th Dec., 1859.

GENTLEMEN,—After reading your notice of the termination of the Board of Trade's inquiry upon the loss of the Royal Charter in "Weekly Gossip," page 380, of your last number, I cannot refrain from troubling you with two remarks, in confirmation of the barren results to public good of such inquiries so conducted. First, it is stated: "Her cables were full 2¼ inches in diameter, and were tested by the makers to 72 tons." Now, Mr. Trotman, in his letter to the *Times*, stated (correctly) the Admiralty test for such a cable is at least 81¼ tons. Permit me to say, with some knowledge of the subject, that 72 tons will rarely pull out the worst of work from a cable of that size, particularly if made of inferior rigid iron; 85 tons would be nearer the strain required to dislodge a half-welded link. Again: why not ask if the Royal Charter was brought up within the breakers that parted her cables? Judging from the evidence upon Captain Taylor's seamanship, he brought the ship up in fair water; if so, did she drift from her first position to where she parted? If she did not drag her anchors, why ease them with the screw? and if she did drag until her anchors held in the *rocky bottom*, which caused the breakers which parted her cables, why not extract this, if possible, by evidence, so that no *shadow* may be thrown over anchors of one model or another.

I am, Gentlemen, a much obliged

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A correspondent writes: "The sad destruction of this fine ship (the Royal Charter), and the fearful loss of property—and, above all, of life—attending that and the numerous other shipwrecks that yearly occur, may well lead every one to exert himself to devise means of preventing them. Your correspondent, Mr. Bendelow, who suggests a method of relieving the strain on cables by means of pulleys, does not, perhaps, remember that the catenary curve of the cable, and the imperfect resistance which the ship opposes to the wave force, do all that can be done at that end of the cable. But at the anchor end there is an unyielding resistance, and when the anchor does not itself drag or break, the parting of the cable often takes place near it. I believe that the true remedy consists in increasing the strength of both anchors and chains; and now that steel is so much more cheaply and easily made, it is inconceivable that, with the interests at stake, shipowners should not take advantage of a material whose cohesive strength is nearly double that of even the best iron. Iron ranges in cohesive strength between 25 and 30, and steel between 56 and 59, tons per square inch of section."

The following letter merits a place here:—

GENTLEMEN,—Having some time ago experimented during two rough trips at sea, an account of the results may perhaps deserve a spare corner in your valuable publication. The first trip I lay as my fellow-passengers did, with my head towards the stern and my feet towards the engine-room (the centre of motion), and on my right side. The result was very much like that of a stomach pump. On the next trip I lay on my left side, with my head towards the engine-room and feet towards the stern. The result was, that I was the only one in the cabin unaffected with sickness; my fellow-passengers lying the contrary way. The *rationale* of these results is clear. The œsophagus or entrance to the stomach is on the left side, the pylorus or eduction on the right. When lying on the left side as described, the centrifugal force from the *rolling* was from the œsophagus to the pylorus, promoting digestion. The centrifugal force from the *pitching* of the vessel was from the head towards the stomach, tending to keep down my good breakfast, and promote digestion also. These effects were of course reversed on my first trip. The rule to be observed is therefore simple: "Lay on your left side with your head towards the middle of the vessel."

I am, Gentlemen, your very obedient servant,

T. MOY.

We understand that a new process of galvanizing wire has recently been discovered by a gentleman connected with the Administration of Telegraphs at Paris, and the application of the invention has been successfully made to the galvanization of telegraph wires. The inventor (Mr. Cuche) states that the chief advantage of his improved method over the old one consists "in its allowing a very thick coating of zinc (which adheres in a most perfect manner) to deposit itself on the wire, which not being afterwards subjected to any friction whatever, prevents any hindrance to the crystallization." The zinc deposited on the wire in this way being much thicker than by the usual process, it consequently resists much longer the action of chemical agents, &c. The discovery has been patented for France and foreign countries, and is said to be already patronized by the principal house which supplies the French Administration with telegraph wires.

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Patents for Inventions.

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STEAM ENGINES, &c., 1122, 1166.

BOILERS AND THEIR FURNACES, &c., 1119.

ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c. *None.*

SHIPS AND BOATS, including their fittings, 1123.

CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 1129.

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1145.

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1090, 1092, 1121, 1124, 1133.

BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c., 1091, 1095, 1097, 1126.

LIGHTING, HEATING, AND VENTILATING, 1098, 1130, 1140.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1111, 1113, 1136.

METALS, including apparatus for their manufacture, 1103, 1115, 1117, 1120, 1128.

CHEMISTRY AND PHOTOGRAPHY, 1099, 1101, 1107, 1139.

ELECTRICAL APPARATUS, *None.*

WARFARE. 1132.

LETTER PRESS PRINTING, &c, 1100, 1110.

MISCELLANEOUS, 1089, 1051, 1093, 1094, 1096, 1102, 1103, 1104, 1105, 1106, 1108, 1109, 1112, 1114, 1116, 1118, 1123, 1127, 1131, 1134, 1135, 1137, 1138.

1089. J. BULL. "Improvements in apparatus used for securing bales of cotton and other substances." Dated April 30, 1859.

This consists in causing the ends of a suitable length of strip metal or of hoop iron to be bent into hooks, and to employ therewith a plate of metal with a rectangular or suitable opening through it, so that when a bale of cotton has by pressure been brought to the desired size, and the strip of metal passed round it, the link or plate is placed on one of the hooks, and then the other hook is passed through the plate, by which, when the bale is released from pressure, the two hooks will be inwards towards the bale, and will be retained secure by the plate. *Patent abandoned.*

1090. C. H. G. WILLIAMS. "Improvements in the manufacture of colouring matters, and in applying the same for dyeing and printing fabrics and materials." Dated April 30, 1859.

By the destructive distillation of quinine, cinchonine, strychnine, or brucine, a series of liquid basic substances is obtained, and it is from such substances that, according to the present invention, colouring matters suitable for dyeing and printing fabrics are manufactured. In employing these colouring matters for printing fabrics, the patentee prepares a solution of the colouring matter as before, and he thickens it with albumen and applies the compound to the fabric by blocks or otherwise. Colouring matters may also be obtained by acting on salts or compounds of aniline, toluidine, xylidine, cumidine, or cymidine with permanganate of potash, and afterwards treating the precipitate. *Patent completed.*

1091. J. SOUQUIERE. "A new or improved process for distilling coal." Dated April 30, 1859.

The patentee claims, 1, the calcination, or destructive distillation of a mixture of pulverized coke and coal in the manufacture of gas for obtaining a larger quantity of gas, and also to render the coke resulting therefrom of more value. 2. The calcination or destructive distillation in coke ovens of a mixture of pulverized coke and coal for producing coke of greater density, which will also produce coke of good quality from any kind of coal. *Patent completed.*

1092. T. H. ARROWSMITH, "Improvements in carding engines." Dated May 2, 1859.

This consists in employing one adjusting screw at each end of the flat, for setting which screw the patentee supports and adjusts a bracket or plate formed to suit the working (technically called the "set of the card"), lateral movement of the bracket or plate being prevented by forming it with a flat surface, and fitting it against the bend of the carding engine, or by a steady pin or other contrivance. *Patent completed.*

1093. A. JUMELAIS. "An apparatus yielding illimited power, so called 'French movement.'" Dated May 2, 1859.

This apparatus consists of a series of tubes tightly connected with each other, each tube containing a helix of ordinary form which actuates a shaft projecting from the said tube, and operating an external pulley. The issuing out of the said shaft from the tube is to take place without any intrusion of the air into the interior of the tube, that is to say, without any leakage, which can easily be obtained by a stuffing box-lid. The permanent pressure is obtained by a double-piston sucking pump, which actuates one end of the connected tubes. *Patent abandoned.*

1094. J. FERGUSON and J. MCGAVENY. "Improvements in fasteners for shutters and for similar uses." Dated May 2, 1859.

The ordinary fastening bolt is here modified so as to become locked by a catch when pushed home into a socket. *Patent abandoned.*

1095. W. BAYLIS. "Improvements in the manufacture of iron hurdles and fencing." Dated May 2, 1859.

The patentee claims so forming the iron for fence rails, either rolling, swaging, or subsequently by hammering or pressing, that it shall partially clip the intermediate hurdle or fence standard, so as to prevent their having any lateral motion. Also the manner of shouldering and forming projections at the ends of hurdles or fence rails where they are united to the end standards; likewise the mode of uniting hurdles and fencing together. *Patent completed.*

1096. R. A. BROOMAN. "Improvements in, and in connection with, electro-magnetic engines." (A communication.) Dated May 2, 1859.

The object here is so to construct electro-magnetic engines, and apparatus connected therewith, that the attractive and repulsive forces of electro-magnets may be utilised and caused to act simultaneously upon the same part or parts of the engine—that the reciprocal action of fixed and moveable magnets may be made available in producing motion—that the electro-magnets employed may be rendered active both by external and internal electrical actions—that the action of the electric current or currents may be practically continuous—and that the maximum magnetic forces may be made available for the production of power. *Patent completed.*

1097. J. BASFORD. "An improvement in the apparatus used when expressing clay or brick earth through dies." Dated May 2, 1859.

This consists in forming the bridge which carries

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the core or interior die in a bent or zig-zag form, and so that the clay or plastic brick earth in place of being cut radially is divided in an inclined direction, by which a lap joint is formed in the clay. *Patent completed.*

1098. J. CHILDS. "Improvements in the manufacture of night-light cases." Dated May 2, 1859.

This consists in wrapping or forming the cylinders of paper or wood on to the bottoms of plaster, cement, or other material, thus forming the upper parts on the bottoms. *Patent completed.*

1099. W. GOSSAGE. "Improvements in the manufacture and useful application of certain alkaline silicates, and in the production of liquor silicis, or liquid fluid. Dated May 2, 1859.

This consists, 1, in using in the manufacture of soluble glass carbonate of potash or carbonate of soda, which has been previously deprived of sulphate of potash or sulphate of soda, the liquid flint thus produced being free from alkaline sulphuret. 2. In the application of such solutions to rendering stones, bricks, wood, paper, woven fabrics, and other materials impermeable to water. 3. In the manufacture of silicate of lime by decomposing solutions of silicate of potash or silicate of soda by caustic lime or carbonate of lime, or by boiling such native silica as is readily dissolved by caustic alkali with a mixture of caustic lime and caustic potash or soda dissolved in water, by which means a silicate of lime is obtained in such state as renders it usefully applicable for promoting the growth of plants. *Patent abandoned.*

1100. D. MOORE. "Improvements in machinery for rubbing or dressing types." Dated May 2, 1859.

This relates to the manner of feeding the types one by one or in a regular manner to the automatic device which takes the said types and carries them letter-end first through or between cutters that rub or cut and remove the projections which remain on the sides of the types and base of the letters after casting. The invention also relates to a device for removing the types from the parts that have carried the said types through the cutters, and receiving the types on an apparatus that reverses their movement or position, and delivers them with their base or lower end first on to an apparatus for setting the types up into line ready for the usual finishing operations. *Patent completed.*

1101. W. GOSSAGE. "Improvements in the manufacture of caustic soda and carbonate of soda, from certain alkaline liquids." Dated May 2, 1859.

The patentee claims, 1, the manufacture of carbonate of soda from caustic soda contained in salts obtained by the concentration of black ash liquors, by exposing such salts mixed with caustic soda to carbonic acid gas. 2. The manufacture of caustic soda (obtained as before stated) by boiling such salts with water and caustic lime. 3. The manufacture of caustic soda by boiling a solution of soluble glass with caustic lime, so as to produce silicate of lime and caustic soda. *Patent completed.*

1102. C. NUTTALL. "Improvements in machinery or apparatus for grinding wire cards." Dated May 2, 1859.

This consists in a method of traversing the strickets or other apparatus used for grinding wire cards. The inventor employs a shaft upon which are cut two threads of screws in opposite directions so as to cross each other, whereby the strickle is caused to travel first in one direction and then in the other. *Patent abandoned.*

1103. F. W. EMERSON. "Improvements in treating ores to obtain a new metallic substance and its salts, and in the application of such matters, and also certain products of tungsten in dyeing, printing, and painting." Dated May 2, 1859.

This consists, 1, in the separation of a metallic substance, which the inventor designates "chrolithineum," from wolfram tungstate of lime, tungstic oxide, and other ores of tungsten, and in the manufacture and application of its various salts to dyeing textile fabrics, painting on porcelain, and the production of paints and pigments. 2. In the manufacture and application of the blue oxide of tungsten as a dyeing substance for textile fabrics, and as a paint or pigment. 3. In the production of paratungstate of alkali, metatungstate of alkali, isotungstate of alkali, and polytungstate of alkali, which may be used in the preparation of paints and pigments, and for dyeing textile fabrics, and for other purposes, and in the combination of paratungstic, metatungstic, isotungstic, and polytungstic acids with any suitable metallic oxide or mixtures of metallic oxides as a base, such as the oxides of lead, zinc, barytes, lime and others, to form paints and pigments. *Patent completed.*

1104. A. G. FRANKLIN. "Improvements in the manufacture of crayons." (A communication.) Dated May 3, 1859.

The required primary colour is mixed with clay, (bolus) well ground together in water, and dried. When the colour is dry, a solution of tragacanth gum is added to it, and the whole kneaded to a paste, of which the pencils are formed by means of a cylinder or press. The pencils are then again well dried or hardened, and dipped in a hot solution of stearine spermaceti and cocoa-nut oil; after about an hour the pencils are taken out, and washed in oil of turpentine. *Patent abandoned.*

1105. W. JOHNSON. "Improvements in the manufacture or production of mineral oil and grease." (A communication.) Dated May 3, 1859.

This relates to the production of oil, oleaginous matters, and grease from mineral shales of various kinds, and from all or any bituminous materials not being commercially and generally known as coal. The raw shale, &c., is primarily distilled in an ordinary retort, and the product is afterwards re-distilled as often as may be necessary. *Patent abandoned.*

1106. T. W. MILLER. "Improvements in apparatus for, and mode of, generating steam and economising fuel." Dated May 3, 1859.

The patentee claims, 1, the construction and arrangement as described of tubes, flues, or sheet spaces for the passage of the heat and products of combustion in a marine or other boiler having several furnaces, laterally and transversely to the lengths of the furnaces, and above or over the bars of each furnace, so that the products of combustion from the first furnace shall pass over the several furnaces between it and the uptake or chimney or outlet, and in like manner the products of combustion from the intermediate furnaces between the first furnace and the uptake or chimney or outlet shall pass over the several furnaces and the fuel therein contained. 2. The arrangement of tubes, flues, or sheet spaces for the passage of the heat or products of combustion in a marine or other boiler having more than one furnace, whether the same be arranged laterally and transversely to the length of the furnaces, or longitudinally, or lengthwise with the length of the furnaces, but above or over the bars of the furnaces, so that instead of passing the products of combustion the first over the second, and second over the third, and so on, they may be alternated and the total length of the furnace be divided into two or more parts, so that the products of combustion from one furnace to another may be led or divided laterally from the front, from the back, and from the centre part of such furnace to the next or to the next but one, or to any other furnace in the series further therefrom. 3. The use and employment of a series of tubes, pipes, or sheet spaces with a suitable entrance pipe and conducting chamber, for the passage through them of the moist steam generated in a boiler, by which the steam in its progress to the main steam pipe of a steam engine becomes dried, or the water held in suspension becomes vapourised, whether tubes, pipes, or sheet spaces be arranged longitudinally or transversely, or in other direction in the upper or in any other part above the level of the water line of a marine or other description of boiler, or in a steam chest open to or separate from a boiler, by which the series of pipes, tubes, or sheet spaces may be surrounded by steam from the boiler and be kept or maintained at the highest temperature due to their position. 4. The novel construction and arrangement of the interior structural parts, as well as the mode of applying surface condensers or refrigerators as described, when such condensers or refrigerators are attached to steam engines or boilers for the purpose of obtaining fresh water from the exhausted steam, or steam otherwise discharged from boilers containing salt or sea water, or water impregnated with impurities, rendering its use destructive to boilers, or from boilers fed with pure and fresh water." *Patent completed.*

1107. W. CLARK. "Improvements in obtaining or extracting quinine and the principal organic alkalies." (A communication.) Dated May 3, 1859.

Here a decoction is obtained from the bark by hydrochloric or sulphuric acids; an alkali or alkaline carburet is then added until precipitation ceases. The liquor holding the precipitate in suspension is then boiled, and a certain quantity of solid fatty acids added; these acids then melt and form a layer on the surface with which all parts of the liquid under the influence of ebullition come in contact successively, and the quinine being dissolved in the water combines with the fatty acids and forms with it a perfectly insoluble soap. After a certain time the precipitate becomes of a blackish colour, and the alkaline liquor is transformed into quinine acid. The liquor is then allowed to cool, when the fatty acids become solidified on the surface, and are removed in the form of a cake and then boiled with distilled water for removing any impurities with which it may be mechanically combined. This is continued until the fatty matter yields nothing more to the pure water; it is then boiled in water acidulated with sulphuric acid, and the excess of acids subsequently saturated by an alkali. Some dark matters will be precipitated, and after filtration a crystallized block of sulphate of quinine will be obtained by cooling, which block may be purified as usual. *Patent completed.*

1108. W. SELLERS. "Improvements in couplings for shafting." (Partly a communication.) Dated May 3, 1859.

This coupling consists of an external sleeve into the opposite ends of which are fitted two other sleeves in the forms of frustrums of cones, the apex of the cones being towards each other. These conical sleeves are bored to fit the shafts intended to be coupled, and are divided by one or two longitudinal cuts to enable them to be closed on the shafts. The sleeves are prevented from turning on the shafts by keys which lock them to the outer sleeve, and they are drawn together by square bolts which pass through part of the external sleeve, and when the nuts on the bolts are screwed up, the bolts will prevent the two internal conical sleeves from turning in the external sleeve. *Patent completed.*

1109. W. SELLERS. "Improved machinery for making screw bolts and nuts." Dated May 3, 1859.

The object here is to prevent the necessity of reversing the motion of the cutting dies, or of stopping the machines to change the bolts, and to so arrange the die and top holder as to admit of greater facility in changing from one size thread to another. *Patent completed.*

1110. J. MORSE. "An improved power-printing press." Dated May 3, 1859.

This invention comprises various features which are not fully described apart from the drawings. *Patent completed.*

1111. L. R. BLAKE. "A new and useful or improved machine for sewing a sole on a boot or shoe." Dated May 3, 1859.

This consists, 1, in arranging the shoe rest on the end of an arm extending from the supporting frame of the machine, and capable of entering the shoe, the said rest entering the interior of the shoe that an outer sole may be stitched upon the inner sole and upper of the shoe or boot. 2. In arranging the thread passage, or looper, or both, within, or so as to operate with, the shoe-supporting arm. 3. In the application of the feeding mechanism to the needle or its carrier, so as to enable the feeding mechanism to be revolved around, or with the said needles and its carrier, in order to change the direction in which the shoe is to be fed along. *Patent completed.*

1112. H. CHAPMAN. "An improved military camp-cooking apparatus." Dated May 3, 1859.

The object here is the obtaining of a large amount of heating surface with a small quantity of fuel. The apparatus is composed of three principal parts, which are intended to contain water at the lower part thereof, except the bottom of the third or middle compartment, which may be used for roasting coffee. At or near the division of each of the aforesaid compartments a dome or other shaped opening is to be formed, from whence proceed tiles or pipes passing respectively through the several compartments in a horizontal direction. The ends of those tubes which come through the outer casing have valves or dampers for opening and closing the ends of the tubes for regulating the intensity of the heat in the apparatus. The before-mentioned compartments are intended to be fitted with shelves, trays, hocks, strainers, and such-like apparatus for performing the operations of boiling or steaming meat, vegetables, and other articles of food. To use this apparatus it is only necessary to place it over two braziers containing fire, the heat from which traversing the several tubes of the apparatus, will be given off, and speedily raise the temperature of the water therein. *Patent abandoned.*

1113. H. CHAPMAN. "Improvements in the construction of kettles." Dated May 3, 1859.

This consists in forming the bottom of the kettle partly flat and partly of a dome shape; from the top of such said dome a tube or pipe extends in a horizontal direction through the body of the kettle and back part thereof, the outer end of the said tube being furnished with a damper or valve for regulating the intensity of the heat. The inside of the kettle at the bottom of the spout thereof may also be fitted with a valve. By thus constructing kettles the fire is not deadened or prevented from burning, but by opening the outer valve aforesaid a draught will be established through the kettle, and thereby cause the fire to burn brightly so that if a fire should be nearly out, it will draw it up, at the same time the heat from the fire, being directed to and through the kettle, will speedily boil the water contained in the kettle. *Patent abandoned.*

1114. E. W. SCALE. "Improvements in railway signals." Dated May 3, 1859.

Here the flanges of the wheels of the engines come

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in contact with and thereby depress the end of a vibrating lever, at the same time raising the opposite end of the lever and pushing a fan signal out of its box; the fan expanding to a semicircular shape simultaneously with this raising of the signal a pneumatic collapsible bag or bellows will be distended and admit air thereinto, and after the flanges of the several wheels in the train of carriages have ceased to act upon the end of the lever, the weight of the rod to which the fan is affixed will cause the pneumatic bag or bellows to collapse and force out gradually the air contained therein, the stop-cocks or valves being so arranged as to cause the signal to be a certain time in descending, thus indicating to a following train the fact of a forward train having recently passed. *Patent completed.*

1115. R. MUSHET. "An improvement in the manufacture of cast steel." Dated May 3, 1859.

This consists in producing a superior quality of cast steel by melting malleable iron together with carbonaceous matter and ores, or oxides of titanium, or titaniferous iron ores, or titanic acid, or deoxidized titaniferous iron ores. *Patent completed.*

1116. W. H. KINGSTON. "Improved means of communication between the passengers and guards, and guards and engine drivers of railway trains." Dated May 4, 1859.

This invention is not described apart from the drawings. *Patent completed.*

1117. C. F. VASSEROT. "An improved form of tuyere for blast furnaces." (A communication.) Dated May 4, 1859.

This consists in a box or air reservoir of cast iron having two elbow pipes, and an opening to receive a cap of cast iron in which is formed the aperture which communicates with the furnace. One of the elbow pipes is fixed to the bellows or the fan; the other passes vertically through the arched masonry into the interior of the furnace. *Patent abandoned.*

1118. J. ADOLPHUS. "An improvement in locks, bolts, and latches." Dated May 4, 1859.

This improvement as applied to locks and bolts consists of a pin, peg, or screw (which when it is desired to secure the lock or bolt) is passed through the fixed part of the lock or bolt, and into, through, or behind the sliding bolt in such a manner that the said bolt cannot possibly be shot back until such pin, peg, or screw has been withdrawn by some person on the inner side of the door, gate, or shutter. Also, as applied to latches in the use of a similar pin, peg, or screw, which when it is desired to secure the latch is passed into, through, or above the latch and into the back plate or the fixed of the latch for the purpose described. *Patent abandoned.*

1119. W. E. NEWTON. "Improvements in steam-boilers." (A communication.) Dated May 4, 1859.

This consists in the employment of perforated air-tubes in the fire-chamber, and above the fuel, which tubes receive atmospheric air from outside the fire-chamber, and discharge its numerous small jets among the gaseous products of combustion. The perforated air tubes are each endorsed within, or are surrounded by, a water-tube connected with the water legs or other spaces of the boiler. The air-tubes are also provided with hollow stay bolts, which form passages for the discharge of the numerous jets of atmospheric air among the gaseous products of combustion. *Patent abandoned.*

1120. J. G. WILLANS. "Improvements in utilizing bog stuff or peat, when applied for treating metals and certain mineral and alkaline substances." Dated May 4, 1859.

The patentee claims, 1, the mixing bog stuff or peat, in the state above defined as undried, with pig or cast iron in a divided state, also the moulding of the same preparatory to its being exposed to heat in contact with the said bog stuff or peat intermixed therewith. 2. The collecting of tar, and other condensable products given off from bog stuff or peat whilst being used as fuel in lime-kilns. 3. The adding to, and intermixing with, ores of iron previously broken or pulverized bog stuff or peat in the state above defined as undried; also the moulding of the said mixture preparatory to its being exposed to heat. 4. The use of bog stuff or peat in the state above defined as undried for mixing with sulphate of baryta or sulphate of soda, preparatory to such sulphates being reduced to sulphurets by the application of heat, all as described. *Patent abandoned.*

1121. J. C. WILSON. "Improvements in machinery for cleaning cotton." Dated May 4, 1859.

Here two rollers are employed in combination with a blade or bar which constantly vibrates or oscillates so as to keep or push back the seeds until they are freed from the cotton and fall down below the rollers. *Patent abandoned.*

1122. H. TURNER. "Improvements in steam-engines and apparatus connected therewith." Dated May 5, 1859.

Here the objects are the economic employment of high pressure steam which has been generated by any suitable means, by using it in the highest degree expansively in low pressure engines, and also in the economical treatment of the steam after it has performed its work in the cylinder or cylinders of a steam engine by the employment of surface condensation, effected by a novel arrangement of surface condenser and centrifugal water-circulating apparatus; also economizing fuel, and securing the continuous supply exclusively of fresh feed water to the boilers of marine and other engines by making up the waste arising from leakages and other causes. It relates more particularly but not exclusively to marine steam engines, and consists in constructing and fitting steam cylinders of larger diameter than ordinarily employed on board ships, and by certain apparatus admitting and employing and using the steam within the cylinder or cylinders from the steam pipe or expansion box at any suitable pressure for only a very small part or portion of the travel of the piston within such cylinder, after which it is allowed again to expand, and being aided by the vacuum on its opposite side the piston moves or travels to the end of the cylinder and thus performs its full stroke; but instead of employing the ordinary air pump and injection condenser he substitutes an apparatus by the introduction of which he is enabled to effect considerable economy in boiler room and the consumption of fuel necessary for generating or producing a given amount of power in engines constructed and worked as heretofore. The details are voluminous. *Patent completed.*

1123. J. F. ALLENDER and D. ROWLEY. "Improvements in shears for cutting boiler plates and sheets, and for other like purposes." Dated May 5, 1859.

This invention is not described apart from the drawings. *Patent completed.*

1124. J. SCHOLFIELD, and W. CUDWORTH. "Certain improvements in machinery or apparatus for spinning cotton and other fibrous materials." Dated May 5, 1859.

This relates to that class of spinning machines known as "mules," "tiviners," &c., and consists in making that part of the mule which regulates the speed of the spindles when winding on self-acting. *Patent completed.*

1125. H. CHAPMAN. "Improved means or appliances for protecting ships against injury from shots, shells, or other warlike projectiles." Dated May 5, 1859.

This consists in adapting a contrivance which the inventor terms a "naval shield" to the sides of the ships, the said shield being capable of being raised or lowered either into or out of the water by a ship's tackle so as to cover any particular part of a ship. *Patent completed.*

1126. H. CHAPMAN. "Improvements in the construction of fortifications." Dated May 5, 1859.

This consists in adapting to fortifications a contrivance for protecting the same against injury from shots, shells, &c., the object being to present a yielding surface to the action of the projectiles for destroying the effect thereof. *Patent abandoned.*

1127. W. F. BATHO and E. M. BAUER. "Improvements in drills for recessing, cutting slots, keyways, and cotter holes." Dated May 5, 1859.

The inventors employ an improved drill or cutting tool having three or more cutting edges, and they form the cutting edges by making spiral grooves on the exterior of the drill in connection with a closed taper recess in the centre. *Patent abandoned.*

1128. E. J. HUGHES. "Improvements in the manufacture of sheet-iron. (A communication.) Dated May 5, 1859.

This consists, 1, in procuring well carburetted charcoal pig iron cold black, and in purifying it either in the refining or puddling furnace by a flux or compound of reagents. 2. In working the iron thus produced in the puddling oven, and with hammers, and afterwards reducing the same into sheets. 3. In passing the sheets through etched or mottled rollers. 4. In enclosing the said sheets in an air-tight iron case and heating them up to a bright cherry red, and then subjecting them to the action of a gang of heavy hammers until they are no longer red; charcoal is used in this process to maintain the heat as long as possible. 5. In submitting the said sheets a second time to the same operation, the amount of heat communicated to them previously being somewhat less, and the hammers of more powerful operation. 6. In enclosing them a third time in an air-tight case for being annealed in a properly constructed furnace. *Patent abandoned*

1129. W. CLARK. "Improvements in seed depositors or drills." (A communication.) Dated May 5, 1859.

The particular feature in this invention consists in the tractive force not being made use of in distributing the seed. For this purpose a special apparatus having a separate motion is adapted to the implements consisting of a spring and train which imparts a rotary movement to a distributor depositing a certain quantity of seed in the ground supplied from a hopper. *Patent completed.*

1130. A. KNOX. "Improvements in gas regulators." Dated May 5, 1859.

This relates to such gas regulators as have a weighted flexible diaphragm upon which the gas admitted to a small chamber acts, and by such action increases or lessens the passage of gas to the burners. The improvements consist, 1, in the arrangement of two or more valves in combination with each other for the admission of the gas to the diaphragm chamber, so that their weight and the pressure of the gas on them counterbalances each other, by reason of which the regulator will work with great uniformity even at the lowest pressures. To effect this the inventor connects the valves by a light lever mounted on a suitable fulcrum, faces the valves with leather and constructs the central spindle supported by the diaphragm of the low pressure chamber hollow. *Patent abandoned.*

1131. H. REYNOLDS. "Improvements in refining sugar and other saccharine substances." Dated May 5, 1859.

The patentee claims, 1, the dissolution of sugar and other saccharine substances by means of an ascending and descending current of fluid propelled by mechanical means. 2. The employment of the salts of tungsten, either as the oxide or in combination with a base, for example, lime or soda, in the refining of sugar and other saccharine substances. *Patent completed.*

1132. R. A. BROOMAN. "Improvements in cannon and other fire-arms, and in projectiles, wads, and cartridges to be used therewith. (A communication.) Dated May 5, 1859.

The patentee claims, 1, the covering of projectiles with an elastic material or soft wire cloth. 2. The employment of an elastic wad or ring attached to the rear end of the projectile. 3. The forming of cartridges of wire cloth or perforated metal plate. *Patent completed.*

1133. H. FLETCHER. "A machine for scutching and carding tow, oakum, or waste cordage." (A communication.) Dated May 5, 1859.

The inventor constructs a machine with a framework of cast-iron, and at one end he has a platform furnished with spikes, amongst which the tow, &c., is drawn and passed by a feed-roller covered with card to a series of four-grooved rollers, which are weighted at the bearings so as to grip the material firmly; it is then subjected to the action of a beater or scutcher which has six bars, three plain and three jagged, so as to beat and spread the material, which is then passed to two carding cylinders, and thence to a doffing cylinder, from which it is combed and passed to a large drum, upon which it is tightly lapped by weighted roller. The various speeds of the rollers, beater, and cylinders are obtained by wheels and pulleys, and he makes the beater shaft the prime mover, and provides the same with a fly-wheel to give the machine a uniform motion. *Patent abandoned.*

1134. W. E. NEWTON. "An improved steam gauge." (A communication.) Dated May 5, 1859.

This consists in arranging or connecting an adjustable weighted index or lever (which travels over a curved scale) to a piston placed in a tube which extends from the outside of the boiler down into the water-space thereof. The pressure exerted by the water in the boiler on the piston will force the latter up in the tube, and this pressure will be indicated on the scale. To the tube is connected a branch pipe or tube provided with a whistle and an escape pipe so that when the piston in the tube is forced up beyond a certain point, and if the water begins to get low in the boiler, the whistle is blown and the surplus steam finds an escape. The piston rod is adjustable by a screw, so that the point when this blowing-off or alarm will take place can be adjusted in accordance with the strength of the boiler. *Patent completed.*

1135. W. E. NEWTON. "Certain improvements in fish-hooks." (A communication.) Dated May 5, 1859.

This consists in arranging between the main hooks and connected to the same by two arms, a bait hook so that by forcing the two arms up to a horizontal position the main hooks are spread open or set, the arms being so arranged that they cannot be forced open up beyond a horizontal position. The top portion of the main hooks is made elastic, so that by the action of this portion the main hooks when set will spring together directly a strain on the bait hook disturbs the horizontal position of the two arms, and thus hold the fish firmly. *Patent completed.*

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1136. J. H. JOHNSON. "Improvements in pianofortes." (A communication.) Dated May 5, 1859.

This relates to a peculiar construction and arrangement of the "rest" and "bridge" of pianofortes, whereby the impediments to the direct vibration of the strings are obviated. *Patent completed.*

1137 W. KELLINGLEY. "Improvements in the mode of lubricating the journals of the axles of locomotive engines, of carriages, and machinery." Dated May 6, 1859.

The patentee uses what he calls a lubricating shield fixed by preference on the axle at the inner end of the journal This shield is so formed that while it prevents the escape of the lubricating matter at the axle, it throws up such lubricating matter into a receptacle, from which it is conducted to any part of the bearing intended to receive the lubricating matter. The shield is formed of brass, gutta-percha, or hard india-rubber. We cannot quote the details. *Patent completed.*

1138. F. ANGERSTEIN, R. CLEGG, and G. THORRINGTON. "Improvements in apparatus for obtaining motive power." Dated May 6, 1859.

One object here is great speed. This is obtained by the use of diagonal arms working on centres, which, by their reciprocal action, produce an increase of speed in proportion to the number employed, the same diagonal motion being converted into a revolving by one or more cog-wheels upon a shaft revolving motion loose with a rim or rims at the side; on the side of the rim or rims a ratchet star or pawl is affixed to a shaft on a square box to fit two or more pawls, which are affixed or allowed to slide on the shaft to catch the top or inner rim of the cog which runs loose each way of its axis; these pawls or ratchets are so fixed as to reverse the motion by any suitable contrivance for throwing the pawls ultimately out of gear. *Patent completed.*

1139. F. W. HART. "Improvements in photographic apparatus." Dated May 6, 1859.

This consists, 1, in constructing a photographic printing frame so as to admit of adjusting thereby the negative stencil or mask on the prepared paper or surface, and securing the same thereon as required. 2. In constructing the said frame so as to adapt it for holding tablets or surfaces to be printed from of varying sizes. 3. In applying vulcanized india-rubber to the bed or back board for the prepared surface to rest upon, to facilitate the bringing of the printing and the prepared surfaces into the required close contact. *Patent abandoned.*

1140. S. WRIGHT. "An improved gas governor or regulator." Dated May 6, 1859.

The patentee governs or regulates the pressure by passing and diffusing the gas through a woven texture of lines, cotton, silk, hair, or it may be a metal fabric into a chamber or chambers to which the burner is attached; the pressure of the gas at the jet of the burner thereby governed and regulated as required. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Oct. 18, 1859.

2376. J. Darlington. Improvements in glass furnaces.

Dated Oct. 31, 1859.

2486. J. T. Pitman. Improvements in the construction of forges. (A communication.)

Dated Nov. 7, 1859.

2534. H. Grafton. Improvements in bell and other signal apparatus to dwelling houses and other places, which improvements are also applicable to knobs or handles and fastenings of doors, and the like.

Dated Nov. 12, 1859.

2572. R. Howson. Improvements in bells and gongs, and in their manufacture.

Dated Nov. 21, 1859.

2629. J. Webster. An improvement or improvements in pressure and vacuum gauges.

2631. W. Whittle. Improvements in the manufacture of nails, and in machinery to be used in the said manufacture.

2633. W. E. Newton. An improved machine for moulding and pressing bricks. (A communication.)

2635. G. W. Lenox. Improvements in the manufacture of ships' blocks.

Dated Nov. 22, 1859.

2639. B. Amsden. Improvements in the manufacture of straw and other descriptions of hats and bonnets.

2641. G. White. Improvements in gloves. (A communication.)

2643. T. B. Daft. An improvement in coating sheathing metal.

2645. C. G. Hill. An improved goffering machine, together with the apparatus connected therewith.

Dated Nov. 23, 1859.

2647. W. H. Ward. A system of signal flags.

2649. E. T. Hughes. Improvements in the manufacture of a certain substance to supersede blasting powder. (A communication.)

2651. E. T. Hughes. An improved chemical combination to supersede blasting powder. (A communication.)

2652. J. T. Smith. An improvement or improvements in heating, puddling, and other reverberatory furnaces used in the manufacture of iron.

2653. B. Bagster. Improvements in means or apparatus for giving surface finish to paper, which improvements are applicable to copper-plate and other printing, as also to embossing.

2654. T. Eastman. Improved means of raising the blades of screws employed to propel ships, and apparatus for getting at such screws, and for performing other operations under water.

2655. T. Lister. Improvements in the construction of sanatory privies and water-closets, part of which improvements is applicable as a tap for drawing off liquids.

2656. J. Knowles, jun. An improved apparatus for the prevention of accidents in winding from mines, which apparatus is also applicable for other similar purposes.

Dated Nov. 24, 1859.

2657. F. Preston and H. W. Garrett. Improvements in the construction of cartridges.

2658. J. Langford. Improvements in inkstands, and in combining with instands instruments for holding and damping stamps, labels, and other articles.

2659. W. C. Maniece. Improvements in cop tubes used in machinery for spinning fibrous substances.

2660. F. Prince. Improved apparatus for reducing the resistance of the atmosphere to the progress of railway trains.

2661. J. Fyfe. Improvements in apparatus for regulating and adjusting the flow and pressure of liquids.

2662. W. Eassie. An improved joint for boarding and planking of all kinds.

2663. A. Hubart and V. Cantillon. Improvements in the manufacture of casks, barrels, and other like vessels of glass, and in machinery or apparatus employed therein.

2664. W. S. Losh. Improvements in the manufacture of paper, and in the preparation of a substance to be employed therein.

2665. W. S. Collins, jun., and F. J. Chard. Improvements in apparatus for propelling vessels.

Dated Nov. 25, 1859.

2667. C., I., and J. Smith. Certain improvements in looms for weaving, and in apparatus for cutting the loops to form pile fabrics.

2668. T. Carr. Improvements in arrangements and mechanism for drying glue, moulded clay, sugar, white lead, and various other substances and articles of manufacture.

2669. J. Sim. Improvements in measuring and registering the flow or discharge of liquids.

2670. I. A. Read and W. Rennie. An improvement or improvements in connecting brooms with their sticks or handles.

2671. H. Lindon. Machinery or apparatus for raising and forcing fluids, which is also applicable for other useful purposes.

2672. M. Tildesley. Improvements in locks and latches. (Partly a communication.)

2673. G. E. Donisthorpe. Improvements in apparatus for hackling, dressing, and combing silk waste, and other fibres.

Dated Nov. 26, 1859.

2674. A. S. Lukin. Improvements in apparatus for drawing window blinds.

2675. F. Scheithauer. An improved machine for printing woollen and other fabrics.

2677. C. Bedells. Improvements in the manufacture of shoes and boots, and in fabrics suitable for use in this manufacture.

2678. W. Moseley. Improvements in fountain pens.

2679. M. Auerbach. Improved apparatus to be applied to omnibuses, stage-coaches, and other similar vehicles, to indicate the distance each passenger travels and the amount of his fare. (A communication.)

2680. T. Watson and G. Healey. Certain improvements in the manufacture of silk velvets.

2681. M. Auerbach. Improved apparatus to be applied to cabs, hackney-carriages, and other similar vehicles, to indicate the number of persons carried, the distance travelled, and the amount of fares. (A communication.)

2682. W. Mac Naught and J. L. Taylor. An improved method of increasing the temperature of water for feeding steam boilers or vessels for generating steam, and in apparatus connected therewith.

Dated Nov. 28, 1859.

2683. J. Eastwood. Improvements in steam hammers, and in valves to be used therewith.

2684. J. Eastwood. Improvements in lathes.

2685. E. Tomey. Improvements in apparatus for insulating telegraphic wires or conductors.

2686. A. W. Williamson and L. Perkins. Improvements in machinery for propelling vessels.

2687. T. Luck. Improvements in apparatus for removing straw from thrashing machines.

2688. P. R. Hodge. The treatment and use of a new material in making of paper or other compounds of vegetable pulp.

2689. E. H. Bentall. Improvements in machinery for cutting vegetable substances.

2690. E. H. Bentall. Improvements in apparatus for crushing or grinding grain or seeds.

2691. J. Bower. An improved method of preparing clay for the manufacture of crucibles, pots, and earthenware.

2692. C. Sells. Improvements in steam-engines.

2693. R. A. Brooman. An improved poultry wagon. (A communication.)

2694. R. A. Brooman. Improvements in the preparation of red colouring matters or dyes. (A communication.)

Dated Nov. 29, 1859.

2695. F. H. Wenham. Certain improvements in steam-engines.

2696. H. Sharpe. Improvements in the mode of preparing wool for the purpose of carding or combing it with a view to its being afterwards wove into thread. (A communication).

2697. J. King and J. Sutcliffe. Certain improvements in and applicable to mules for spinning.

2698. H. O. Robinson. Improvements in machinery and apparatus for the manufacture of sugar.

2699. J. B. Berger. An improved mode of and apparatus for facilitating the calculations required for navigating ships or vessels.

2700. L. N. Dejean. Improvements in hydraulic motive power.

2701. C. Colwell. An improved means of propelling sea-going vessels without the use of either paddle-wheel or screw propeller now adopted.

2702. T. Richardson. Improvements in the manufacture of certain compounds of soda and potash.

2703. M. L. J. Lavater. Improvements in vulcanized india rubber bands.

Dated Nov. 30, 1859.

2705. T. Fitton. Improvements in the slide valves of steam-engines.

2707. S. Mortimer and G. Swaine. Improvements in machinery or apparatus for spinning and doubling wool or other fibrous substances.

2709. J. M. Wilson. Improvements in finishing woven fabrics called Arabian stripes or scarfs.

2711. J. B. Teil. Improvements in the construction of umbrellas and parasols.

2713. G. J. Firmin. Improvements in the manufacture of tartaric and citric acids, and certain salts in connection therewith.

Dated Dec. 1, 1859.

2717. C. A. Fournier. A process and apparatuses intended to find out the escapes of lighting gas from the conveying pipes, and to determine the precise leaking places of the said pipes.

2719. T. Silver. Improvements in apparatus for governing or regulating the speed of steam and other engines.

2721. T. Till. Improvements in machinery for the manufacture of horse-nails and other wrought nails.

2723. J. Paton. Improvements in valves.

2725. J. H. Johnson. Improvements in apparatus for preserving and cooking food. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

2731. G. F. Smith. Improvements in smelting and purifying iron and other ores. (A communication.) Dated Dec. 2, 1859.

2740. J. Anderson and J. Bradshaw. Improvements in the construction of the furnaces of bakers' ovens for the purpose of consuming smoke, which improvements are also applicable to the consumption of smoke in other furnaces. Dated Dec. 3, 1859.

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NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(From the London Gazette, Dec. 13, 1859.)

1710. J. G. Isham and S. D. Albertson. Corks. (A communication.)
1779. J. Rowland. Mashing and mixing.
1783. J. C. Ashwell. Wheels.
1789. W. K. Peace. Canisters. (A communication.)
1791. W. H. Tooth. Iron and steel.
1793. J. Petrie, jun. Washing wool.
1801. F. Walton. Ornamental fabrics.
1805. N. D. Maillard. Compases.
1806. M. A. F. Mennons. Sentry boxes, &c. (A communication.)
1810. F. W. Beaumont. Hydraulic apparatus.
1811. W. Thompson. Printing telegraph.
1815. A. B. Childs and L. D. Owen. Cleaning grain.
1816. A. T. De Lisle. Clarifying sugar.
1827. B. Baugh. Forming the edges of certain vessels.
1837. P. F. Rolland. Electric telegraph.
1838. C. L. J. Dierickx. Scales.
1844. W. Williamson. Drilling holes.
1849. W. Muir. Foot lathes.
1855. R. Heaton, jun. Coining machinery.
1861. L. A. Possoz. Sugar.
1874. R. I. Watts, J. Offord, and J. R. Thomas. Consuming smoke.
1875. H. T. Lambert. Disengaging ships' boats. (A communication.)
1901. J. Chatterton. Tubes of gutta percha.
2149. J. Blair. Spinning, &c.
2174. J. Fernihough. Pistons and buckets.
2268. J. Turpie. Sails of ships.
2302. G. Davies. Paper. (A communication.)
2319. A. A. D. Hely. Tobacco.
2460. H. Phillips and J. Bannehr. Manure.
2532. H. Barker. Pipes.
2604. J. A. Drieu and A. Legeay. Tissue.
2610. J. McKenzie and S. T. Wentworth. Fire-arms.
2617. W. Blinkhorn. Bricks, &c.
2645. C. G. Hill. Goffering machine.
2669. J. Sim. Measuring liquids.
2673. G. E. Donisthorpe. Hackling, &c.
2685. E. Tomey. Insulating wires.
2713. G. J. Firmin. Tartaric and citric acids.
2723. J. Paton. Valves.
2740. J. Anderson and J. Bradshaw. Furnaces.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Dec. 9, 1859.

1414. W. Donbavand and D. Crichton.
1417. T. F. Henley.
1433. J. Cowan.
1442. J. Luis.
1444. L. Barroux.
1458. H. Evette.
1534. D. J. Fleetwood.
2015. W. Neilson.

Sealed Dec. 13, 1859.

1422. B. Baugh.
1426. C. N. Kottula.
1435. A. McDonald.
1436. E. J. Maumené and V. Rogelet.
1441. E. T. Hughes.
1443. J. Luis.
1449. T. E. Tallent.
1451. A. McDonald.
1459. E. T. Hughes.
1463. C. F. Vasserot.
1466. J. Combe and R. Smalpage.
1467. J. Luis.
1468. J. Cox.
1480. R. Laming.
1500. C. F. and C. J. Varley.
1543. G. Hall, jun.
1548. I. Tirebuck.
1596. A. Beaulieu.
1607. L. Schwartzkopff and F. C. Philippson.
1618. J. H. Johnson.
1664. R. Mushet.
1665. R. Mushet.
1674. R. Mushet.
1707. Earl of Caithness.
2069. E. J. Mallett.
2251. J. Thompson and J. Thompson, jun.
2411. T. S. Prideaux.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2892. H. Ogden and H. Hibbert.
2902. J. Leslie.
2905. R. Eaton.
2915. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith.
2916. T. Peake.
2926. W. and T. Storey.
2936. T. & W. Wheatley.
2950. J. T. and E. P. Wright.
2957. H. Pease and T. Richardson.
2977. E. Heywood.
3004. F. Donny.
3059. C. F. Varley.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1013. G. Collier. | 1853—219. J. S. Russell.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Dec. 2, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
1092	9 6	1103	9 5	1114	1 3	1125	0 3	1136	0 10	1147	0 3
1093	9 3	1104	0 3	1115	0 4	1126	0 3	1137	0 9	1148	1 3
1094	0 2	1105	0 3	1116	1 2	1127	0 3	1138	0 9	1149	2 2
1095	9 7	1106	1 6	1117	0 3	1128	0 3	1139	0 3	1150	0 4
1096	9 7	1107	0 4	1118	0 3	1129	0 7	1140	0 5	1151	0 4
1097	0 5	1108	0 3	1119	0 7	1130	0 3	1141	0 3	1152	0 3
1098	0 3	1109	0 10	1120	0 4	1131	0 4	1142	0 10	1153	1 0
1099	0 3	1110	0 10	1121	0 3	1132	0 2	1143	0 6	1154	0 9
1100	0 11	1111	0 10	1122	1 11	1133	0 3	1144	0 8	1155	0 3
1101	0 4	1112	0 3	1123	2 10	1134	0 5	1145	0 6	1156	1 0
1102	0 3	1113	0 3	1124	0 6	1135	0 5	1146	0 3	...	...

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

SWORDS AND SCABBARDS, *India Office.*—For swords and scabbards. Conditions of contract at the Secretariat Office. Tenders before 11 o'clock a.m., Dec. 03.

CHURCH, *Norton Malward.*—For the rebuilding of Norton Malward church near Bristol. Drawings, &c., offices, Mr. James Wilson, architect, No. 1 Belmont, Bath. Tenders, Dec. 24.

TOWER AND SPIRE, *Moreton-in-the-Marsh.*—For a new tower and spire to the parish church. Plans, &c., after Dec. 19, to T. Commeline, Esq., Moreton-in-the-Marsh. Tenders to 3 p.m., Jan. 2.

WORKHOUSE, *Bristol.*—For enlarging the City of Bristol Workhouse at Stapleton. Printed forms of tender, Mr. W. B. Wilmot, clerk to the guardians. Plans, &c., at St. Peter's Hospital, Bristol. Tenders, Jan. 11.

ENGINEER'S WORK, *Bristol.*—For the engineer's work to be done in enlarging the City of Bristol Workhouse at Stapleton. Form of tender, Mr. W. B. Wilmott, clerk to the guardians. Plans, &c., St. Peter's Workhouse, Bristol. Tenders, Jan. 11.

PLAN OF DRAINING, &c., *Eastbourne.*—For the best plan of draining the parish of Eastbourne. Map of parish, plan of additional buildings, levels, &c., Mr. M. G. H. Crampton Coles, clerk to the board, Eastbourne. Plans to be accompanied with a specification of the work to be done, and estimate of the cost, and sent to the office of the clerk, Jan. 17.

RAILS, *Dublin and Wicklow Company.*—For 4,400 tons of bridge rails 80 lbs. to the yard, for the Gorey Extension line, with a proportionate quantity of chairs, according to particulars with the company's engineer, W. R. Le Fanu, Esq., 59 Fitzwilliam-square, Dublin, to be delivered free on shore at Wicklow or Arklow, in three equal quantities of 6, 12, and 18 months, from date of acceptance of tender. Tenders to Mr. A. Moore, secretary, 48 Westland-row, Dublin, Dec. 29.

CHAIRS, *North British Railway Company.*—For 2,300 tons of chairs. Specifications at the head office of the company, Edinburgh. Tenders for whole or any part before noon, 23rd inst.

RAILWAY MATERIALS, *Border Counties Extension Railway.*—For the following materials for permanent way, viz.:—23,000 sleepers, 56,000 chairs, 56,000 keys, 112,000 twisted spikes, 16,000 fishing plates, 32,000 fishing bolts. Forms of tenders, offices, Mr. J. F. Tone, 10 Market-street, Newcastle. Tenders, 22nd inst.

STORES, *Blythe and Tyne Railway.*—For waggon wood, and other home and foreign timber, for iron, copper, brass, nails, spades, shovels, bolts, &c., and for other stores for the ensuing year. Forms of tender, &c., Mr. Lundie, manager, Percy Main, or at company's offices, Newcastle.

FREIGHT TO INDIA, *Calcutta and South Eastern Railway.*—Freight for two locomotive engines and tenders, in a first-class vessel, from Newcastle-upon-Tyne to Calcutta. They will be ready for shipment in the beginning of January next. The tenders to specify a lump sum for the conveyance of each locomotive and tender; the weight and dimensions of which to be ascertained at the offices of the company, 211 Gresham-house, Old Broad-street, or at Messrs R. Stephenson and Co.'s, Newcastle-upon-Tyne. Tenders at the office of the company till noon, Dec. 24.

GASHOLDER TANK, *Rawtenstall.*—For the excavating, shoring, puddling, and mason's work required in the construction of a gasholder tank, 80 feet diameter by 20 feet deep, at the company's works, Bacup. Sealed tenders to be furnished by the secretary, and sent in to J. Aitkin, Esq., chairman, 28th Dec. inst.

CHURCH, *Newcastle-upon-Tyne.*—For the erection of a new church in Bath-lane, Newcastle. Drawings for and copies of quantities, Messrs. Oliver and Lamb, architects, 66a Northumberland-street, Newcastle. Tenders, Dec. 19.

CHURCH, *Dover.*—For building a new church for the parish of St. James the Apostle, Dover. Drawings, &c., office of Mr. T. Fox, vestry clerk, 3 Castle-terrace, Dover, where copies of bills of quantities and forms of tender may be obtained on payment of a sum of three guineas for each copy. Further particulars Mr. T. Bury, 30 Welbeck-st., Cavendish-sq., London. Tenders, Dec. 21.

SCHOOLS, *Esser.*—For the erection of three large schools and residences at Epping. Plans, &c., Offices of Mr. G. E. Pritchett, 12 Bishopsgate-street Without, and Bishop's Stortfort; also, at Rev. J. R. Tuck's, Epping. Tenders, Dec. 23rd.

DESIGNS AND ESTIMATES FOR SHOP AND HOUSE, *Hull.*—Designs for a draper and silk mercer's shop and dwelling house on the site of the shop and retail premises, in the Market-place, Hull. Premium of ten guineas for most approved plan, to Messrs. R. Jennison & son, drapers, Hull, Dec. 19.

ENGINEER, Practical and Educated, to erect and superintend the working of sugar and other machinery. A thorough practical knowledge of the steam engine and millwright's work, and having served the regular time in the shop, is indispensable. A competent person, producing first-class references as to ability, character, &c., will be liberally dealt with. Address, P. S. & Co., 163 Strand, stating all particulars.

GAS ENGINEER.—Must be thoroughly acquainted with engineering in general, but gas engineering on a small scale in particular, in all its detail. Must be a good draughtsman and accountant, and capable of preparing specifications of brick and wood work, as well as iron work. Salary, £100 a year. References to three last employers required. Address, V. 36, *Examiner* office, Manchester.

GAS ENGINEER.—The Sowerby Bridge Gas Company require the assistance of a practical gas engineer to examine their works, and report to them his opinion as to the best mode of enlarging the same. Address, stating terms and reference, to the Chairman of the Company, Sowerby Bridge, Yorkshire, Dec. 19th.

MANAGER OF GAS WORKS.—To take the management of the Todmorden Gas Works, and to do the general business of a gas-making establishment. Address, Mr. J. Barker, engineer, Millwood, Todmorden, giving references and salary required.

MANAGER FOR ENGINEERING WORKS.—Must be a good mechanic, thoroughly systematic in conducting and getting out work, and a fair draughtsman. Applicants to give full particulars of previous engagements and references. Salary, £120 a year. Address, X. O., 163 Strand, London.

MECHANICAL AND TOPOGRAPHICAL DRAUGHTSMAN.—One thoroughly competent to go out to Rio de Janeiro. A German, Swiss, or Pole, who can speak English, will be preferred; salary liberal. Address, Messrs. Fairbairn & Sons, Canal-street, Manchester.

MECHANICAL DRAUGHTSMAN.—One experienced in making working and finished drawings, capable of designing and arranging machinery, and possessing a practical knowledge of mechanical engineering, millwrighting, &c. Address, stating salary, L. T. G., 163 Strand, London.

BRASS TUBE MILL MANAGER.—To superintend a brass tube mill. Must be experienced in making bata cast, drawn, and brazed brass and copper tubes, and thoroughly understand the nature of metals. Address by letter, H., 3 *Journal* office, Birmingham.

SECRETARY AND GENERAL MANAGER, *Halifax.*—For the Halifax Mechanics' Institution. An active intelligent man, who will be expected to devote his whole time to the duties of his office. He will be responsible for the efficient working of the several departments of the Institution, and arrangements will be made for the purpose of giving him a pecuniary interest in its prosperity. The salary will be £100 per annum. Applications by letter only, not later than 20th inst., to Mr. Carter, secretary.

PRICES CURRENT OF METALS.

London, Dec. 16th, 1859.

		£ s. d.		£ s. d.	Pr. cent.
IRON:					
Rails in Wales and North of England	pr. ton	6 0 0	to	6 5 0	
Welsh Bars, in Wales	,,	5 17 6	,,	6 0 0	
Staf. Bars, at the Works	,,	7 5 0	,,	7 15 0	2½
,, Hoops	,,	8 5 0	,,	8 15 0	,,
,, Sheets, Singles	,,	8 10 0	,,	9 10 0	,,
,, Nail Rods	,,	7 5 0	,,	7 15 0	,,
,, Boiler Plates	,,	8 10 0	,,	9 0 0	,,
Scotch Pig, M.Nos. Warrants, at Glasgow	,,	2 17 6	,,	2 17 9	cash
Do. No. 1, Good Brands	,,	2 18 0	,,	2 19 -	,,
Scotch Bars	,,	7 10 0	,,	8 5 0	,,
Swedish Bars, in London	,,	11 10 0	,,	12 0 0	2½
COPPER:					
Sheet and Sheathing	per lb.	0 0 12½	,,	0 0 0	3
Tough Cake and Tile	pr. ton	112 0 0	,,	0 0 0	
Best Selected	,,	115 0 0	,,	0 0 0	
Australian	,,	112 10 0	,,	113 0 0	
South American	,,	0 0 0	,,	0 0 0	
Yellow Metal Sheathing	per lb.	0 0 13½	,,	0 0 0	
STEEL:					
Swedish Keg	pr. ton	19 0 0	,,	19 10 0	2½
,, Faggot	,,	21 0 0	,,	21 5 0	,,
TIN:					
English, Block	p. cwt.	6 18 0	,,	0 0 0	2½
,, Bar	,,	6 19 0	,,	0 0 0	,,
Foreign, Banca	,,	7 1 0	,,	0 0 0	cash
,, Straits	,,	6 16 0	,,	0 0 0	,,
TINPLATES:					
Charcoal, I.C.	pr. box	1 12 0	,,	1 12 6	3
Coke, I.C.	,,	1 6 0	,,	1 6 6	,,
LEAD:					
Pig, English	pr. ton	22 0 0	,,	23 0 0	2½
,, Spanish	,,	21 15 0	,,	22 5 0	,,
Sheet	,,	22 10 0	,,	23 0 0	,,
SPELTER:					
On the spot	,,	21 10 0	,,	21 15 0	cash
For arrival	,,	0 0 0	,,	0 0 0	,,
ZINC:					
English Sheet	,,	27 0 0	,,	0 0 0	10
QUICKSILVER	pr. btl.	7 0 0	,,	0 0 0	2½

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 23, 1859.

OUR NATIONAL DEFENCES.

THERE is a wonderfully simple means of defence accessible to us English people that has been many times suggested by individuals, but never, we believe, taken into serious consideration by the authorities. We allude to the adoption of locomotive batteries, transportable from place to place around our coast on lines of railway. The Professor of Fortification at Addiscombe, Admiral Sartorious, and Mr. Bridges Adams, (in *Once a Week*,) have all and severally proposed the employment of such a system of defence; and only last week we learned that Mr. John White, the eminent shipbuilder of West Cowes, Isle of Wight, no less than two or three years ago devised elaborate plans of carrying this system—which he seems to have been one of the very first to devise—into effect.

Knowing as we all do, or may easily do, every assailable portion of our coast, and possessing as we possess the power of rapid transit which railways afford, it seems the height of folly to invest large sums of money in fixed defences. What could be easier than the simple process of connecting all or several of our assailable points by trunk lines of railway—placing upon, or in connection with them, a sufficient number of guns to meet every possible emergency—and furnishing ourselves with such an amount of locomotive power as would enable us to concentrate as many of our guns as we please upon any threatened point in a few hours? Taken broadly, it is possible that on close inquiry it would be found that no impediment would prevent us from suddenly concentrating *all* the strength of our coast artillery upon a single point if desirable; but even if such obstacles as the mouth of the Thames, the Southampton Water, Plymouth Sound, and other estuaries, were found to render this impracticable or undesirable, there could yet be no difficulty in bringing an overwhelming artillery force to bear upon every point where an enemy could land.

The advantages of such a system of defence must be very great. In the event of any attempt at an invasion being contemplated, we could put all our defensive artillery force into a state of preparation, and on the approach of the enemy, the telegraph would at once put every division of the force on the alert. No feints of the enemy could avail him anything, because our locomotive land force could be shifted from point to point, as he varied his position, with much greater facility than fleets of transports could be moved. On the actual landing being attempted, we should have the invaluable power of taking up whatever position we found best—either directly in the face of the landing force, or at any convenient distance from it, raking it more or less as opportunity served. Surely with the fleets of England afloat, and defences of this kind girdling our coast, we might lay down our heads at night in any corner of our happy island fearless even of Imperial France!

In times of peace our coast artillery might be maintained at exceedingly little expense—at the mere cost of the guns and carriages, in fact, for the locomotives, and even the railways, might then be used for civil and commercial purposes. Such artillery could, moreover, be worked with all needful efficiency by volunteer forces formed along the coast, and, if necessary, batteries of guns could be transported from place to place to afford opportunities for all the corps to exercise themselves with by turn.

THE GREAT EASTERN.

A FREE press is a blessed thing unquestionably, but it often works much mischief. We do not, we are happy to say, believe that newspaper writers can repeal or set aside the laws of nature—fortunately for us; but they can do marvellous things in the way of casting discredit upon human enterprises even of the highest kind. What wonders have they not worked lately in reference to the Great Eastern! The design of that ship, in all its essential parts, has been before the scientific public for several years, and we never yet knew of any serious criticism adverse to it proceeding from any distinguished men of science. Men of science, moreover, have lately made two or three trips on board of her, and have discovered nothing seriously defective about her, so far as we have heard. But newspaper writers have done what men of science did not do, and their clever disquisitions, aided by some singular proceedings on the part of the directors of the Great Ship Company, have brought the shares down ridiculously low.

How far there is room to doubt whether Mr. Scott Russell's late contract was fully and faithfully completed or not we cannot tell, simply because we never saw the specification of the contract, and have not the slightest knowledge of its extent or limitations. We know, of course—as everybody else knows—the directors themselves long ago announced that the contract *was* finished entirely to their satisfaction. But since then the question has been raised, and has very properly been submitted to the decision of duly appointed arbitrators. While these arbitrators have been investigating the subject we have seen and heard much on one side of the question, while on the other side Mr. Russell has maintained silence. For our part, while we *know* that an immense amount of nonsense has been written about the condition of the ship, and while we further know that Mr. Russell spared no expense in performing his contract, we shall not be surprised to find that he gets mulcted to some extent by the arbitrators, simply because we believe no considerable quantity of contract work can be expected (in the present state of commercial and manufacturing affairs) to stand close scrutiny unblemished. But however this matter ends, it can bear but very slightly upon the actual value of the Great Eastern. Mr. Russell's last contract may have been well done, or it may have been ill done, but that is a mere question of a few hundred pounds at most; the value of the ship as a commercial instrument or agent cannot be greatly affected by it. As to the folly which we hear and read, about the paddle-engines being placed too low, and other such matters, no scientific man will give heed to that for a single moment until something more than gross absurdities are brought forward in support of it. We say this, not with the slightest disposition to check any sensible discussion of the great ship's construction and qualities; on the contrary, we will gladly open our columns to any *scientific* letters or papers on the subject; but we say it because we have not patience to comment upon the utterly senseless writings which have recently appeared in imposing forms in reference to the Great Eastern.

Holding these views—which we know *must* be shared by all our professional readers—we have observed with satisfaction that Mr. William Hawes, a highly influential member and officer of the Society of Arts, has just been laying before that Society a valuable paper upon the Great Eastern. In this paper the writer opportunely recals public attention from the "petty jealousies of little minds," and from the "misrepresentations of ignorant and interested opponents," and directs it to the ship as "a great mechanical and engineering "work, fraught with great commercial and "political results, the accomplishment of which "may be retarded by bad management, but "which will certainly be ultimately realized, "however gloomy for a time the prospects may "appear." For the sake of a magnificent ship, which only its owners take pains to undervalue, we are pleased with Mr. Hawes' undertaking, and will glance at her anew in the light which he throws upon her.

There is much truth in what Mr. Hawes says in reference to the present management of the ship. No one, as he observes, appears to have sufficient authority to decide what is to be done, and few of those who are now connected with the administration of the company's affairs appreciate the vastness of the original design, fewer still being able to carry it out in its integrity. Judging from the criticisms we have all read upon the ship of late, we might fancy, he remarks, that neither of the experienced engineers of the paddle and screw engines knew anything of their business; for one critic says the chimneys are too small; another, the boilers are insufficient; another, the diameter of the paddles is too great; another, the air-pump rods are too weak, and the engines themselves are in the wrong position; another finds fault with the donkey engines, and so on throughout the ship, "all of which criticisms "seem rather to originate in a desire to spend "the money of the company, or to obtain a "false reputation by appearing to remedy evils "which do not exist, than to complete in the "shortest time the work that is unfinished, and "to remedy, in the most economical manner, "any defects in her machinery and apparatus "which her trials may have rendered apparent." There is also much truth in his remarks upon the gorgeous and expensive fittings of the principal saloon. He believes the interests of the shareholders, and good taste, too, would both have been better consulted, if the utmost simplicity in ornamentation had been adhered to, and more attention paid to the introduction of the comforts we are accustomed to ashore, and which the steadiness of, and the space at command in, this ship would have enabled the directors to realize, to the infinitely greater satisfaction of passengers than any pleasure that sitting in a gaudy saloon can afford them. He also notices a remark which has been made respecting the absence of means to warm the state room and other saloons in a ship going to America. The ship was never intended to go to a cold climate; she was built for the Indian trade; she is not calculated for a voyage to America, and it is to be very much regretted that the concession to other interests than those of the shareholders, and perhaps the desire of exhibiting this great work to our transatlantic friends, should have been allowed for one hour to delay her departure on the voyage for which she was designed, for which she is fitted, and from which alone commercial results to the company can be realised. "The ship has been "looked upon too much as a sight, and far too "little as a great commercial machine by the "proper use of which alone can profits be "made." It is clear, he adds, that one great element of commercial success is to be found in

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not allowing this great capital to be idle in port; another in avoiding, as much as possible, the dangers of passing to and from any coast, whereas by sending her to America the delays in port must be tenfold her time on the voyage —indeed so long that smaller steamers will fill with passengers and cargo and make the passage while she is loading, if indeed she ever will be loaded there. The whole object of the enterprise will thus be defeated, capital will be uselessly lying idle, and wages and expenses will be as uselessly paid. Then, again, as to the risks incidental to the voyage. We all know how comparatively small they are in a well-found ship when once at sea, and most are equally well aware of the risk in approaching the English and American coasts, of the fogs and ice incidental to the vicinity of the one, and the dangers of our rocky shores and narrow seas. "I never have been able to understand," says Mr. Hawes, "why the directors determined "to send this ship even one voyage to America, "or to spend the large sum they have done in "fittings before the ship and machinery had "been tried, and the speed of 15 or 16 knots "per hour, which none doubt will be accom- "plished, had been proved to the satisfaction of "the world. I have always maintained that, as "soon as she was launched, and the machinery "completed, by which I mean everything re- "quired for her safe navigation, sufficient "ballast and coal should have been shipped, "and a voyage of 1,000 or 2,000 miles per- "formed, with or without her masts. If that "trial had been successful, money would have "been easily raised to finish her in any style "the builder or directors might have chosen; "if a failure, the shareholders would have saved "the £100,000 spent in fittings and ornament." We need hardly say how entirely and cordially we agree with these remarks.

The fact is, there is no visible hope of doing anything useful with this ship until the object with which she was designed and built is once more set before her proprietors. How will she answer for the passage to India?—answer, that is, in a commercial sense? is the one inquiry which should be resolved with all possible haste. If she can accomplish what her designers promised, there can be little doubt, as Mr. Hawes remarks, that a fleet of such ships will soon be built, and a visit to India *viâ* the Cape will become one of our holiday trips, the passage being performed in a luxurious hotel instead of by the overland route, which "con- "centrates in a journey of six weeks as "much discomfort as it appears possible to "experience in so short a time." Mr. Hawes states the conditions of the question in the following manner:—The cost of a passage to Calcutta is now £102, and, excepting servants, is limited to 1st class. If the Great Ship Company, relying on her size and economical arrangements, boldly meets the wants of the time, and charges but £60 for a 1st class, £40 for a 2nd class, and £25 for a 3rd class passage, and freight at proportionately low rates, its annual earnings and expenditure—so soon as her speed is proved, and making two voyages only—may be estimated thus:—

INCOME OUTWARDS.

400 passengers	at	£60	£24,000
500	at	40	20,000
3,000	at	25	75,000
10,000 tons of cargo	at	3	30,000

INCOME HOMEWARDS.

300 passengers	at	£60	£18,000
300	at	40	12,000
2,000	at	25	50,000
10,000 tons of cargo	at	3	30,000
			259,000
Two voyages—annually			518,000

EXPENDITURE.

Two Voyages—Coals	£80,000
Officers, Engineers, Crew, &c., wages	20,000
Dietary for Crew and Passengers	60,000
Engines, Oil, &c.	5,000
Working Expenses	50,000
Wear and Tear	50,000
Depreciation	50,000
Insurance	50,000
	365,000
Balance or Profit	153,000
	£518,000

No estimate is made of the receipts likely to be derived from mails, parcels, or specie. But exclusive of these sources of income there can hardly fail to be, if this amount be even near to correctness, an ample return to the shareholders, and if the wear and tear be estimated at the cost of the ship to the present company, the result will be much more favourable; but Mr. Hawes has estimated them upon what he assumes would be the cost of a second or sister ship. He considers there will be no difficulty in obtaining a sufficient number of passengers or tons of freight to fill the ship so long as we are annually exporting to or importing from India £15,000,000 to £20,000,000 value of manufactures and merchandise, and employing hundreds of thousands of tons of shipping, especially when we recollect that the line by these ships will be a trunk or feeding line to the whole of our Indian empire and the Eastern world. The cargo of 10,000 tons at high rates will consist of the first-class goods required at every port to which we trade, and the advantage to merchants on either side, whose intelligence and good information enables them to foresee a coming demand before it actually arrives, of receiving goods by a conveyance as quick and regular as that which conveys the orders, cannot be overrated. At present orders are received by the overland mail to be forwarded by sea, the shipment of which is notified to every one by our Customs' reports, and frequently in time to enable merchants having no similar orders of their own to make shipments on the faith of the known intelligence of others, which goods may arrive as soon, or perhaps sooner, than those shipped by the parties by whom, in anticipation of a demand, orders were first transmitted to England by the overland route. To ensure the earliest possible arrival of goods after the receipts of orders will command, Mr. Hawes argues, an amount of freight which this ship, capacious as she is, will hardly be able to carry. Commercially, then, the establishment of a trunk route which shall combine speed and comparative cheapness, must command as large a share of business as can be undertaken by a fleet of such ships to sail monthly from either terminus. It appears to him almost impossible to appreciate, much less to estimate, the effect of thus reducing the distance between England and India; even the effect produced upon the home trade by the introduction of railways, or the increased facilities for our correspondence by the joint effects of penny postage and railway conveniences, invaluable and startling as they are, or the daily increasing traffic between England and America, since 1838, when the first passage was made, to the present time when steam-boats are running almost daily, offer but poor means of estimating the advantages to be derived from bringing several hundred millions of fellow-subjects and their wants within a few days of our shores. Surely, as he says, support ought not to be wanting to aid in overcoming the difficulties attending the commencement of so vast an undertaking, for when once the fact is established means will soon be found to develop it more fully.

Much misconception, owing no doubt to a vague idea of the real distance to Calcutta, to the great length of time occupied by clipper ships and auxiliary steam-ships in the voyage, and to the apparently (as compared with them) very short time given to the Great Eastern, has got possession of the public mind as to the speed per hour necessary to accomplish the duty undertaken. The speed proposed by Mr. Brunel in the first-published prospectus, in 1852, was that "which experience proves such "vessels to be capable of, and which will per- "form the voyage easily in 32 days." To do this he determined to employ engines of 2,600 horse power, consuming from 250 to 300 tons of fuel per day, and 15 knots per hour is stated by him as the required speed. Is this rate likely to be realised? "The trials prove," says Mr. Hawes, "as far as they go (the en- "gines never having been worked to full speed), "that after a little working, when everything "is in order, this rate will be attained." He then argues,—the distance to Calcutta is 11,819 geographical miles or knots; the time to Calcutta by Peninsular and Oriental ships, 38 to 40 days; time to Calcutta *viâ* Marseilles, 34 to 36 days; time to Calcutta by Great Eastern at, per hour, 16 knots, 31 days; 15 knots, 33 days; 14 knots, 35 days; 13 knots, 38 days; cost of first-class passage by Peninsular and Oriental boats and rail, £102; do, per Great Eastern, £60; Luggage for each passenger (free) 336 lbs. per Peninsular and Oriental; do., 40 cubic feet per Great Eastern; charge for extra luggage per Peninsular and Oriental boats at the rate of £36 per ton; do. per Great Eastern, say £12 per ton; trade to India—Tonnage cleared to Calcutta, Madras, and Ceylon (1858), 294,162 tons; estimated annual value of trade to India, per annum, £15,000,000 to £20,000,000. From 12 to 15½ knots have already been done with a maximum rate of 12½ revolutions of the paddle and 40 of the screw engines per minute; give them 16 and 48 respectively, and more than the anticipated duty will be done.

In comparing her speed with that of our large ocean passenger ships supported by large Government subsidies, it must not be forgotten that while by this ship it was proposed to accomplish a higher average ocean speed than has yet been attained, it was also calculated to carry so many passengers and so much freight that it should be worked profitably without subsidy, the sum annually paid by Government to mail steamers being £982,000; of which £167,125 is paid for the Indian route; £204,000 is paid for the Australian; £172,840 is paid for the American; and £244,000 is paid for the West Indian. In every other fast passenger ship the coals and engines, even for a short voyage, occupy so much of the ship that but little freight can be carried, and only a limited number of passengers in proportion to the size of the ship, and these mainly of the first class. "They occupy "the same relative position in ocean travelling "to other steamers that the fast coach or the "mail did to the six-insider of former days. "The one quick used only by the rich, the "other slow, but paid for by the public." Railways, continues Mr. Hawes, have abolished this distinction ashore; rich and poor travel at nearly the same speed, though at varying rates; and this great ship is the first step in the same direction afloat. Mail coaches required subsidies; by rail the mail is carried at rates scarcely equal to the actual cost of transit. So the mail steamers now built cannot run without subsidies; "and as the rail has beaten the coach, so "we hope in this ship to beat the subsidised "mail steamers in speed and economy, and thus "to secure large public support, which is of in-

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"finitely more value than a Government subsidy. "The one tends to check progress so long as a "contract continues; the other stimulates and "encourages it, because it rewards every im- "provement." At 15 knots per hour this ship will reach Calcutta in 32 days, and at 16 knots in 30 days and 12 hours, with a consumption of fuel, when the aid of trade winds and favourable monsoons is allowed for, not exceeding 280 tons per diem. We may fairly expect from what has already been done, that when every- thing is in order, and all hands, from the cap- tain to the stoker, are up to their work, and the engines do the duty assigned to them, this speed will be attained, and the distance accom- plished in the time originally contemplated. Extra speed can only be attained by the dis- placement of passengers and cargo; and it is the skill with which the space allotted to ma- chinery—the source of expenditure, and that allotted to passengers and cargo—the sources of income, have been determined, that forms the best ground of our hope that this ship, when the first difficulties of starting so novel an undertaking are overcome, will be a great com- mercial success. Disturb the one, and the rates for the other two must be increased, and our surest element of prosperity destroyed. These facts are strikingly illustrated by Mr. Hawes, who compares some of our largest pas- senger ships with the Great Eastern, thus :—

Ships.	Tonnage.	Horse-power.	Coals per Day.	Speed per Hour.	Cost.	Store of Coals for	Carrying Power for Passengers and Cargo.	
Great Eastern	22,500	2,600	300	kts. 14	650,000	dys. 40	Persns 4,000	Tons. 10,000
Atrato ..	2,720	800	95	11½	105,000	15	194	300
Shannon	3,092	800	92	11½	120,000	15	268	450
Persia ...	3,585	1,000	140	11½	140,000	14	350	400

Or, as compared with the average of these three ships.

The Great Eastern has cost ... 5 times as much.
" " " is ... ... 7 times larger.
" " " has ... ... 3 times the power.
" " " has at 14 knots 1·22 times the speed.
" " " carries 40 days' fuel against 15.
" " " has carrying or commercial power for passengers 15 times greater.
" " " for cargo 26 times greater.

In all these ships—and they fairly represent the subsidised mail and passenger ships—it will be seen that the quantity of cargo carried is trifling in proportion to their size, and that the expenditure of coals in proportion to size and speed is enormous; and whilst, with a horse- power of 1 to 3 or 4 tons of burthen, they give an average speed of only 11 knots per hour, the Great Eastern, to run 15 knots, has but 1 horse- power to 8½ tons burthen. Mr. Hawes sums up thus :—"This then is the measure of the "advantage gained by her beautiful form, great "size, but comparatively small steam-power. "We have a higher speed by a vessel 7 or 8 "times larger than any afloat, than has yet been "attained—capable of carrying from 5,000 to "10,000 passengers, or 4,000 passengers and "10,000 tons of cargo; burning per hour but "three times the quantity of coals now used by "ships one-eighth her size, and carrying fuel "for 40 days steaming instead of for 15 days— "can any one doubt this being a great advance "in ocean steam navigation? Railway speed "was never the object of the engineer, but large "carrying power with great safety, at a speed to "accomplish the distance to India in the same "or in less time than by the overland mail "route, with the economy of ordinary clipper "ships, *was his object*, and, as far as we can see, "it appears likely to be fully realised."

We cannot pass over without a few words the last portion of Mr. Hawes' remarks—those on the national importance of this great under- taking. At present, the most rapid means of intercourse with our Eastern possessions is through France, across the Mediterranean, and through Egypt by the Red Sea to the Persian Gulf. This route can be stopped at any moment by the Emperor of the French. The next in shortness is by sea to Alexandria, which can be very much endangered by French fleets, and thereby deprived of its certainty and safety, besides the risk attending the transit through Egypt. Such are the difficulties and expense of this route, that it can only be maintained by aid of an enormous subsidy from the Govern- ment, and even then with very high charges for the conveyance of passengers and small parcels; to commerce it is entirely inaccessible. The charge by the Peninsular and Oriental Com- pany is, by sea to Calcutta, £102, and the ordinary time required to reach Calcutta is 38 days, or four days less at an extra charge, *vid* Marseilles. The Great Eastern, therefore, will forestall the arrival of the Peninsular and Oriental boats, by several days, at Calcutta, and this without subjecting either letters or pas- sengers to the risks and inconveniences of three times passing through foreign countries, or to being transferred from one conveyance to another, or to being interfered with from political disagreements between France and ourselves. By such means, then, may our Eastern possessions be brought not only so many days nearer to us, but the communica- tion be rendered more safe than, and equally certain as, by the existing routes. Every one must at once see the importance of thus re- ducing the distance as measured by time be- tween India and this country, especially if at the same time we afford infinitely superior means than now exist for transporting an al- most unlimited number of troops and material or merchandise to and from any part of our distant possessions.

One Great Eastern will not suffice, probably, either for commerce or the Government, when her power and speed are fully proved. The objection made by many that it would not be pru- dent to put 5,000 or 10,000 troops in one bottom is, as Mr. Hawes observes, most futile. Let it be proved that this conveyance is the safest, the quickest, and most certain, and the objection fails at once. Experience has fully proved that large ships are safer than small ones, and no one ever thinks of refusing to take a passage in a good ship because she carries a large number of passengers.

SILVERTOWN.

AN important social "experiment" is at present being simultaneously tried in various portions of the British dominions, and is watched with con- siderable interest by true and zealous philanthro- pists. We allude to the foundation of training schools, where a solid but plain education, and a knowledge of the manufactures carried on around, go hand in hand in fitting the offspring of the men employed upon the works, of both sexes, for their future independence and well-being. The enormous factories at Saltville, for the manufac- ture of woollens, the extensive glass-works of Messrs. Chance and Co., near Birmingham, and the extensive producing resources at Silvertown, opposite Woolwich, are successfully developing results in the highest degree encouraging to the permanent unity and good fellowship of the em- ployer and the employed.

The impression left upon our minds by a visit to the latter place, which, through the courtesy of the Messrs. Silver, we thoroughly inspected, was one of a very promising description, arising from the undisguised cheerfulness and systematic order which appeared to reign throughout the varied ramifications of this vast concern. Indeed, although the proprietors with commend- able modesty consider it *an experiment*, our belief, from no little experience in such matters, would lead us to pronounce it a *fait accompli*, and one which is eminently deserving of the most serious consideration of those who are unselfishly devoting their minds, both privately and legislatively, to the welfare of succeeding generations. The manu- factures pursued at these works, which stand on ten acres of ground, are manifold in their cha- racter, and rise by almost imperceptible degrees from the merest mechanical application of the fingers alone, to matters which are engaging the most gifted minds in these days of rapid intel- lectual progress; from the punching of holes in wood, in metal, or in composition, and the cane- bottoming of a chair, to the highest branches of practical science. It is impossible to conceive an area more fraught with promise; for there exists an appropriate sphere within reach of every capacity, be that capacity mental or me- chanical, or both. In the school, which is a lofty, well-ventilated structure, we found some sixty children, boys and girls, the offspring of the work-people, under the tuition of a master and mistress, assisted by monitors selected from the more advanced of the pupils. In order not to tax their young energies too stringently, one half of the children is mentally employed, while the other half is mechanically so, and a liberal regard to out-door amusements in the field within the bounds of Silvertown healthfully tempers both exertions. Those of the children not in school are employed principally in minor portions of car- pentery—in the caneing of chairs, sofas, &c., for the cabins of ships and officers' outfits, and for domestic purposes in India and our colonies. It was interesting to notice the growing intelligence of the children in these branches of industry, the fingers of some plying the split cane in the reticulation of the seats of the chairs with a sur- prising celerity, while others, but young begi- ners, did and undid their work in evident mortifi- cation at their own incipient want of skill. Each child receives payment for its work according to its quality and quantity, and some of them, mere babes, obtain about six shillings a week for the short period of the day they are thus permitted to employ their time. It was obvious to us that this was a very happy state of things, showing a very far-seeing policy upon the part of the heads of the works, inasmuch as the child is not only reared to an independent position by the know- ledge of a trade, while it is receiving that religious and moral education without which the greatest mechanical acquirements are rendered so often unstable, but the parents themselves working almost in sight of their offspring are relieved from that depressing and feverish weight of anxiety which is ever attendant upon the parental care of children not similarly provided for. These children, as they rise in mechanical acquirements, work immediately under their parents' eye, and in due time, in sickness or death, succeed to their positions and emoluments. A committee of taste, tending to bring out the latent talent of old and young, is amongst the noticeable features of this community; and from time to time plans and models are examined, and suggestions for the ad- vancement or improvement of any of fourteen different descriptions of trades carried on at Silver-

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town are examined and canvassed, and prizes awarded for those of a practical nature. A Mutual Improvement Society in connection with the former, gives unity and force to its other beneficial tendencies. The school-room serves as a temporary place of worship, a chaplain being appointed to the duty. This gentleman does not, however, confine his ministrations to these works, but extends them also to the numerous employés at the warehouses in Cornhill and Bishopgate, where social and religious meetings take place monthly, marked by appropriate addresses, prayer, &c. A mechanics' and news institute are likewise in full and useful exercise in one of these warehouses, in which classes for instruction are formed, and lists of sessional lectures printed and delivered by its members.

To return to Silvertown: the parents of this infant colony work at the more matured requirements of the factories, which are devoted to ponderous machinery of Herculean strength for the mastication of crude india-rubber, until that wondrous product acquires its perfect protean powers, and is converted into rick and waggon cloths, carriage aprons, macintosh and various waterproof garments, waterhose of almost endless lengths, air goods, such as life-boats, mattresses, cushions, inflated children's balls for play—a comparatively recently manufactured article of very extensive use. Buffers, washers and bearing springs now so extensively used for machinery, are here likewise turned out after the severest tests in almost fabulous quantities. The tenacity and power of resisting great weights as evidenced by these washers, as well as the buffers and packers similarly constructed for railway carriages, is something marvellous. The manufacture of hose for water pipes, &c., is another branch of this peculiar industry, which more than usually interested us, inasmuch as we saw no less than sixty feet of rubber placed around a mandrel or tube, and after being joined throughout the whole of this length, the entire mould or tube was withdrawn by one man with an ease and facility which at once proved how little friction must exist between metal and this extraordinary compound. This fact is surely as suggestive as it is curious. It is likewise within the precincts of these works that india-rubber is undergoing trials for the purpose of being enlisted yet more extensively as an important auxiliary for the more impervious insulation of electric-wires.

The houses already built at Silvertown are some fifty in number; they are without the gates of the works, and from external appearance seem to be inhabited by an industrious community, who intuitively entertain a high regard for almost a Dutch notion of cleanliness. The street is wide, well paved, drained and lighted, and in it we noticed a store for food. The latter we were informed was self-supporting, and each article being bought at trade price, and of the leading wholesale houses, its purity and economy are ensured. It is again retailed at a fractional advance of cost to meet the contingent expenses of rent, &c. A medical practitioner is also attached to the firm, and a sick fund has likewise been established under proper regulations, which not only brings with it a due amount of independence, as the men find in it a fund which provides for accidents, but absolves them from the necessity of seeking eleemosynary aid from their employers. The houses devoted to the chaplain, the manager, and principal clerks are within the gates, and are well built, commodious, and comfortable structures. Indeed, everything around bears the unmistakeable impress of a well-organised system, which distributes industry, ease, and happiness over the largest surface.

Although the products of this industrial town are enormous in their aggregate, the warehouses in London take their share, and some hundreds of men, women, and the youth of both sexes, are there employed in the completion of shirts, knapsacks—both for military and touring purposes—belts, caps of all descriptions, toilet requirements, clothing, &c., &c., as well as the resources of a private outfitting trade for Great Britain, the magnitude of which can best be judged of by a glance at the busy scene of the packer's department upon the basement of these establishments, where enormous cases are being labelled with their various destinations, and are constantly departing for shipping to almost every quarter of the world. This department, and the general sample room, where specimens of the manifold articles manufactured by the firm permit of the merchant selecting at once and giving his orders, perhaps best served to convince us of the magnitude of the manufactures carried on by the firm, to which we have to tender our thanks for the courtesy which thus permits us to afford our readers a slight, and, we trust, interesting insight into its workings.

ON HEAT.

EXPERIMENTS AND OBSERVATIONS TENDING TO PROVE THAT THE HEAT WHICH DR. BLACK DISCOVERED TO BE ABSORBED DURING THE LIQUEFACTION OF ICE, AND WHICH HE CALLED LATENT HEAT, IS NEVER GIVEN OUT AGAIN ON THE FREEZING OF WATER, WITH REMARKS ON A PECULIAR PROPERTY WHICH SEEMS TO BE DEVELOPED IN WATER AND MANY OTHER FORMS OF MATTER ON CHANGE OF STATE.

By HORATIO PRATER, Esq.

(*Continued from p.* 378.)

THAT the theory of the separation of atoms being the cause of cold is right, follows also from Sir J. Leslie's experiments on the exhaustion of air (*i. e.*, separation of the space between its atoms). "The thermometer always suddenly sinks a few degrees* when in the receiver, (says Thomson, p. 108.) And the sudden rise to so great a degree when air is let in again, is also best explained by the theory now proposed. The density of air being ·0,0003, Leslie found that the degree of heat produced by letting the external air rush into the receiver, so as to return to density 1, was so wonderfully great as 13,500° F., and even when the air was 0·2, was as high as 216° F. (p. 111.) Some heat in this case may be generated by the friction of rushing in, but the greater part is probably due to the atoms of air COMING CLOSER TOGETHER THAN USUAL, in consequence of their having been previously placed in an unnatural and forced state of VERY great separation. The degree of cold will be greater the greater the RAPIDITY of the action of separation of atoms, whether in the case of the solution of salts, or of the exhaustion of air, and *vice versâ*, as regards the production of heat. But in both cases *rapidity of action* must be regarded as an essential element, whether of the production of cold or heat, only that the motions will *be inverse;* but the idea of *pressing out* or drawing in of an *ether* (the cause of heat) seems to explain the effect just as well (to say the least) as the theory of the *opposite motion of atoms*.

In the case of snow and water at 172° the more rapid and greater production of cold than when water at 32° is used, is also to be paralleled with the greater production of cold when snow and muriate of soda are used, than when water at 32° and muriate of soda are used. I have already stated that in this case the production of cold *certainly* greater than what the mere absorption of 140° can account for, is to be attributed to the natural action being hurried, and in the same way when snow is dissolved in water at 172°, I may ask whether, at least, part of the cold produced is not to be ascribed to a similar cause?†

I know that an attempt has very lately been made to show that the same actual amount of heat is produced, whether some metals oxidise slowly or rapidly. But I must be allowed to doubt whether these experiments are satisfactory; and I believe any person will agree that they cannot apply to the slow or rapid oxidation of iron; for to conceive by any *slow* operation as much heat is *altogether* given out as when it burns in oxygen gas seems *actually impossible;* and for the simple reason, that no man can measure exactly the very high degree of heat produced by this latter experiment. This heat, like that produced by heating *vitreous* selenium slowly to 192°, when it *suddenly* rises to 450° (Regnault's Cours. I. p. 245), by the cold powder of antimony in chlorine, and by potassium when laid even on ice, or when the rays of a powerful sun fall on sawdust moistened with oil, or by Sir J. Leslie's air-pump experiments, nay, even by igniting a lucifer match, &c., &c., is so great that it forces us to acknowledge the truth of the theory I have elsewhere advocated, of the generation of heat from heat, much in the same way in which life is generated from life.

It will be seen that I admit that Dr. Black's theory is true as regards the absorption of heat when ice becomes water. I shall now proceed to show that his experiments are not so satisfactory when he attempts to show that water gives out these 140° again when it becomes ice.

The following experiments (says Thomson, p. 160) prove that the heat of 140° which enter into ice to change it to water, are "not altogether destroyed." (1) "If when the thermometer is at 22°, we leave a vessel of water at 52° to the *open air*, and beside it another full of brine at the same temperature, with thermometers in each, we shall find that both of them gradually cool to 32°. After this the brine (which does not freeze till cooled to 4°) cools gradually to 22°, the temperature of the air; but the pure water remains at 32°, and freezes very slowly, and never gets below 32°.* Now, is it not probable that the water as it freezes gradually gives out the heat of 140° it absorbed during its liquefaction, and that this evolution maintains the temperature of the water at 32°, notwithstanding what it parts with to the air during the whole proceedings?

Now, I may observe that the reason why the *water* does not fall lower than 32°, seems to depend on the sudden production of a *nisus* at this temperature to *resist change of state* (for this is the *natural* freezing point), which *nisus prevents the equilibrium of heat being established*, just in the same way when a similar sudden production of force (*nisus*) prevents the water in a red-hot crucible arriving at a heat above 96·5 C. (Boutigny), or *altogether* to the boiling point.

This theory seems well to explain the fact that induced Thomson to think that the above experiment almost proves the evolution of 140°, viz., that the *brine* may be cooled to 22°. But why? Because as this does not freeze till at 4°,† the

* Of course this separation of atoms is the cause of the cold produced by evaporation. It also explains why high pressure steam does not scald, at least when this is allowed to *expand* by rushing into the air. Also the freezing of water when this is put in anhydrous sulphuric acid in a red hot crucible, the separation of atoms being *so quick* and wide of the ether *evaporating*, while the fluid portion remains under 32° F. But as so *little water* is used when the hand moistened is dipped in melted iron, *by itself* (unless the sudden expansion of air in the water and *all about the hand* assists) it seems inadequate to explain this wonderful fact. It explains well the sudden sinking of water from 418° to 212° in Papin's digester, when the steam is let out. (Thomson, p. 195.)

† The particles of snow are separated *rapidly* from each other, hence there should be an *extra* production of cold *over* the 140° theory. As the force of heat is used to overcome *cohesion* in the two cases in the text, is it not natural to suppose that the force should be diminished or destroyed by its *struggle* with cohesion? To assert, as Black's 140° theory does, that one force can conquer another force *without losing any of its power*, is contrary to all analogy. When the cohesion of zinc is destroyed by solution in dilute sulphuric acid, heat instead of cold is produced in consequence of the *very rapid* combination of the acid and metal; hence IMMEDIATELY on the separation of homogeneous atoms, there is a CLOSER UNION of heterogeneous atoms.

* Thomson must mean till long after it is frozen; for ice at 32° may be cooled to 22°; though the operation is slow.

† The addition of salts makes freezing, as well as boiling, more difficult; and it is worthy of remark that as chloride of calcium impedes freezing more than chloride sodium (salt), so it impedes boiling more, and while salt (30 to 100 parts) water boils at 224°, it (with a saturated solution of the former) does not boil at 264°. (Thomson, p. 179.) But as according to Despretz's experiments, when 149·176 parts of chloride of sodium are dissolved in 1000 parts water, the freezing point of the solution is 14·440°, and with the same quantity of chloride of calcium in the same quantity of water, is at 15·962°, and with ditto of carbonate of potash, it is at 30·4880°. (Thomson, p. 156. Tables.) In this case, then, the *nature* of the salt seems to make a great difference, and it does not act merely mechanically by any supposed *separation* of the atoms of water; Sir C. Blagden's experiments on *other saline* solutions (p. 154) prove the same. It is curious, however, that common salt is even a little more powerful than chloride of calcium, seeing that in *freezing mixtures* it lowers temperature so far less.

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nisus in this case has no need to be developed, and is not, till the solution is cooled far beyond the temperature of the air (viz., 22° F). That "what it parts with to the air" is a pure assumption on the part of Drs. Black and Thomson, is shown by the lame way (on this occasion) in which Thomson proceeds. "If," says he, "a delicate thermometer is suspended above water while freezing, it is constantly affected by a stream of air *less cold*! (sic) than the air around." (p. 161.) Observe here a "delicate thermometer" is to be used, and *even then* air "less cold" is only given off; yet if even only ¼ of 140° had been given out, it should not only have affected a "delicate thermometer," but even the hand, as he tells us is the case "when heat is entering ice." "Place even *the hand*," says he, "under the vessel, and a current of cold air may be felt *descending* from it during the whole process of liquefaction" (p. 160), and, of course, a *common* thermometer also proves it. (Experiment 2.) "Let a tall beer glass, *covered*, and nearly full of water, with a thermometer in it, be exposed when the air is at 22°. In this case it cools down to 22° without freezing. Things being so, if the water be shaken, part of it freezes, and the temperature of the *whole instantly* rises to 32°. Now, whence come these 10°? Is it not evident that water in the act of freezing gives out heat?" (p. 161.)

As I have found by experiment that the temperature of water is not sensibly raised by violent shaking, this evolution of heat does not arise from the "shaking" made use of, as indeed is clear from turning to p. 154, where we find "that any solid body dropt in water so cooled—whether it be a pin, a grain of salt, a piece of animal or vegetable substance, causes freezing and the rise to 32°. Agitation, or even wind, *provided all solid matter be excluded*, does not seem to act." Hence, the the agitation said to produce the effect in the first quotation (p. 151), is *by implication* made to depend on the atoms of dust (solid matter) always floating in the air. And we find that Thomson "has cooled water in thermometer tubes to 8°, and once to 5° before it began to freeze, and even then it rose to 32° on freezing" (p. 154).

Now, when we consider that water may certainly be cooled to 5° (and probably even lower) without freezing, here we have at the beginning presumptive evidence that this evolution of heat and the rise to 32° is to be attributed to the *physiological* cause (if I may venture so to speak) that makes a corked and saturated solution of the carbonate or sulphate of soda crystallize, and, at the same time, evolve heat* on removing the cork, &c., &c., and that the evolution of heat is the effect to a certain extent of this cause, which in ALL cases may be called an assistant cause of freezing? Else, how is it that water has not a FIXED point down to which it may be cooled without freezing? Why sometimes to 22°, sometimes 5°, as I observe since this essay was written, as has been confirmed by others. (See Prof. Regnault's *Cours Elementaire*, Tom. 1, p. 104, 1858-9.)

The secret of cooling below 32° seems to depend on the prevention of even the SLIGHTEST degree of motion, from the contact even of the invisible particles of dust always in the air; in fact, to freedom from all irritation; hence, in the experiment first quoted, we find, as the vessel was "uncovered," the water never fell below 32°, though the brine did (the air being only 22°). By these observations I do not mean to deny that probably a great increase in the degree of cold (to −30°, or less, for example) would overcome this *anti*-freezing action of ABSOLUTE freedom from the irritation of dust, but this does not prove that freezing is always a PURELY physical act, as is supposed, for life itself can exist for a time under the action of a great degree of cold, but increase this, and life is *at once* extinguished and becomes *impossible*.

But the cautious reader will observe that in the case the water is cooled to 22° there are only 10°, and in case it is cooled to 5° there are only 27° *seemingly* given out—a very different temperature from the presumed 140°. This brings us to the famous attempt of Thomson to prove by experiment that *in reality* these 10° or 27° indicate 140°, and thus to remove the great defect in Black's theory, probably seen by him, but considered incapable of explanation. (Experiment 3.) "From many experiments," says he (p. 161), "I have found reason to conclude that the quantity of ice which forms suddenly on the agitation of water, cooled down below the freezing point, always bears a constant ratio to the coldness of the liquid before agitation. Thus, I find, when water is cooled down to 22° very nearly ⅛th of the whole freezes; when the previous temperature is 27°, about ⅛th of the whole freezes. From analogy, I conclude that for every 5 degrees of diminution of temperature below freezing without congelation, ⅛th of the liquid freezes suddenly on agitation. Therefore, if water could be cooled down 28 times 5° below 32° without congelation, the *whole* would congeal instantly on agitation, and the temperature of the ice would be 32°. Now, 5 × 28 = 140° gives us precisely the quantity of heat which, according to Black's experiments, enters into ice to change it to water."* Thus when water is cooled down to 22°, every particle of it wants 10° of the heat necessary to keep it liquid; (I may here by parenthesis observe that it does not, for it *still remains liquid*); 13 parts of it seize 10° each from the 14th part. These 13 acquire the temperature of 32°, and the other part being deprived of 10 × 13 = 130°, which with the 10° it had lost before, make 140° (its heat of fluidity), assumes the form of ice."

Now, Professor Thomson tells us, "he was not able to make experiments below 22°," and hence he has been obliged to conclude "from analogy," that ⅛th part freezes for every 5° we descend below 32°. But surely "analogy" would induce us rather to think that the *lower* we descended, the proportion of ⅛th would be far more likely to increase than remain fixed, since the cold is so far greater. I may add to this objection that the very ingenious attempt to make *exactly* 140° rather overshoots the mark, for Cavendish thought 150°,* Wilkie 130°, Laplace 135°, and Person (the latest experiments) 79·25° C., *about* 159°† F. disappear during the melting of ice.

This theory also seems to *assume* another doubtful point, namely, that the 13 parts can be in *actual* contact with the 14th part frozen; for if not, as *water is so bad a conductor of heat*, they surely could not rob it of 140°. But as 13 spheres of the same size can't be all *at the same time* in contact with one, this 14th part losing *instantly* 140°, which it must do, for the freezing "is sudden into a spongy mass" (p. 161.), seems entirely theory. But this "spongy mass," as it nearly fills the vessel, should instead of 10°‡, give out 140°, *or nearly so*, as he himself tells us twice that the freezing in this case is very sudden. And the want of this *sudden* effect (*in common freezing*) is the reason why he, and Dr. Wilson more lately, viz., 1854 (Chemical Treatise), assert that we cannot mark by the thermometer that 140° are evolved. The formation of ice is so very slow that these 140° escape *imperceptibly*, say these authors; but in the present case it is not so, and I may add that as the AIR is always something below 32, often below 22°, when water freezes, I think in *all* cases these 140° (or rather part of them) should escape quickly enough to be *very easily* observed by the thermometer, nay, even by the touch. Had freezing in general taken place when the air *was nearer* this temperature of 140° (say only 60°), then indeed as they would have been *far* longer in passing to it, we might conceive them lost by absorption. But air at 32°, or lower, should surely *always* be very suddenly raised by them, and in a very obvious manner, on the ground of heat seeking its equilibrium more quickly the greater the difference of the temperature of the bodies. Indeed these reflections induce me to doubt if water *in common circumstances* could scarcely ever be frozen except at the very surface, if it required to give out again these 140° before freezing, since the air itself would be so much heated by the very operation of freezing. The temperature of the air being 70°, I filled a vial with water heated to 168°, and found that in ten minutes the temperature of the air in a tumbler was raised to 86°, when the vial was left *corked to prevent heating from steam* in the tumbler *uncovered*. I found by placing the bulb *in contact* with the side of the vial, that this was raised to 103° in five minutes, and remained there; consequently glass heated to this can raise the temperature of surrounding air from 70° to 86° (the mean of two experiments with two thermometers). Air, then, has an absorbent power, as the experiments of Professor Tyndall (*Bibliothèque Universelle*) have very lately shown, and consequently the temperature of this will be raised at least 10° or 12° if 140° are really given out from water during freezing. But our quotations from Black show that it is not, and a "*delicate* thermometer" only proves the air above freezing water "less cold" than air around!

The attempt to prove that no part even of these 140° can be detected because the freezing is slow, may be upset again by putting water in a glass globe with a narrow neck, and applying a freezing mixture (snow and salt) to the globe. The water suddenly starts up, then subsides, and after an interval rises again slowly, *then shoots into ice with the greatest velocity*. (Thom. p. 20.) And the "pro-

* See these experiments, Thomson p. 173. In the case of carbonate of soda 14°, and in that of sulphate of soda 24°, are given out under such circumstances. Thomson, by a similar line of argument to that used in experiment 3 (see further on, has tried to prove that these numbers represent in each case *a part* of the latent heat of the water of crystallization, viz., 140°; but, if possible, less successfully, I think, than in the case of water cooled to 22°, and rising to 32° by freezing, because, even if water of crystallization be solid, as he asserts, it can only be solid from what may be called a state of chemical combination, just as oxygen united to iron, as oxyde of iron, is solid. In neither of these cases is the solidity exactly the same, as in the case of ice, as the temperature at which they exist is so much higher, and I have just found that by crushing sulphate of soda between folds of blotting paper that this is wetted by the water of crystallization fixed between the pores of the salt unchanged. It is curious that the above solutions—like water brought to 22° without freezing—must be cooled and corked "*without agitation*;" hence there is a great analogy between the cases. As these salts are very soluble, water has a strong attraction for them. Is there not then a *nisus* produced in the water to prevent the salt leaving it by change of state—by crystallization? This would tend to explain the reason why the salts do not fall till the cork of the vial is removed; but when by doing this, *irritation* from particles of dust always floating in the air is produced, the crystallization takes place from the same physiological cause that makes water at 22° freeze and rise to 32° by its crystallization, so to call it.

* In all this Thomson has omitted to comment on the main point, viz., *why*, when water is *below* 32°, it must always rise to 32° before it assumes the solid state of ice. This should at once have induced him to think that the giving out of these 10° had nothing to do with the *supposed* giving out of 140°, and *formed no part* of these, but depended upon the same physiological cause that makes melted tin when cooled down to 438°, or 4 degrees below its freezing (solidifying) point, *rise instantly* to 442° (its solidifying point), when it congeals (Thomson, p. 153, Crichton's Experiments). These 4° have nothing to, do with the heat of fluidity of tin, why then should the 10° evolved when water is cooled to 22°? It would appear that bodies may have *too much cold* for congealing, and that they all have a *fixed* temperature for such change, probably because this *favours better the new arrangement of atoms*, obliged to be made, when they change from fluids to solids.

Since the above was written, I see that Regnault says:—"This rise of temperature is observed in the solidification of *all* bodies when during fusion they are cooled below their solidifying point." This, then, will confirm my view, given at length, that the development of a *nisus* during change of state is a property of matter generally. He also says (1): "A strong vibration (*shock*) will cause congelation of water cooled much below 32°, though the introduction of a foreign body does it more easily (*mieux*)." And he seems to say (2), "that the *whole* of the water gradually freezes under such circumstances (Op: cit: Tom. 1, p. 104), and that it resists, and remains at, 32°, till the freezing is complete. Thus, on the first of these two points, he is *certainly* at variance with Thomson's statement above quoted; and also, most probably as regards the latter, and if in this latter he is right, we have still stronger reason for rejecting Thomson's attempt to prove that 140° are given out when water freezes.

* Phil. Trans. 1733.

† Péclet. (*Traité de la Chaleur*, Tom. I, p. 461, 3iemo edition. 1860.

‡ Could water freeze at 22°, even these 10° would not be given out. On obvious principles they are given out because the water is excited by an irritation to freeze or *change the arrangement of* its atoms, and it can only do this at 32°.

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digious force generated by this expansion is shown by the experiment where it burst a brass globe an inch in diameter by freezing." (Thom. p. 34.) Reaumur found cast-iron, bismuth, and antimony also expanded on becoming solid. (p. 34.) But they probably do not expand to near the extent of ice on its formation, the expansion being so great as "10 per cent. of the volume of water."* (*Phil. Magazine:* June 1855.)

We may here pause, and ask the origin of this vast force in all these cases. And first, as there are probably many other cases besides the above, we may ascribe the origin of it to a general property of matter, viz., a tendency to resist a change of its natural (usual) state, and the consequent production of a NISUS whenever such change is forced on it. As regards water especially, we may ask, supposing *all* the 140° to exist in it at the time of the formation of ice, would not this vast EXPANSIVE effort (doubtless caused by the air being forced by being at or below 32°, to attempt to extract the heat of the water) at once ABSORB CERTAINLY, and thus prevent any extrication of heat in freezing? Regarding, then, this expansion as another argument against the evolution of 140° by freezing, I may also regard it as showing, perhaps, an *unusually powerful nisus* in water compared with almost all other matter, seeing that this requires energy enough to expand (as it were, in very defiance of heat) while some *small portion* of heat is probably LEAVING it (if such heat is not converted into this pure repulsive force?); for certainly no heat is entering into it, to expand it. It would almost seem in reference to the query just put, that the *nisus* of water to resist change of state is even strong enough to subdue the very nature of heat itself (*since it expands as forcibly* WITHOUT THIS, *as most forms of matter can do with it*), and separate its *pure* repulsive element from that peculiarity in it which excites what we call pain—in fact, to decompose heat, which must be the case if "latent heat" is even indirectly the cause of the expansion.†

Since water may freeze, and never rise above 32° while the air itself *remains* at only 22° (as formerly stated), here again is another argument against its giving out 140°, for, if it did, the air should rise above 22°; yet the same men who furnish us with these interesting facts, seem never to think them adverse to the 140° theory.

There is also another point they and the late writers on "Conservation of Force" overlook, viz., that when one force grapples with another force, EVEN SUCCESSFULLY—as when the absorption of 140° certainly is necessary to render ice fluid, or water—these 140° may still possibly, if they be not actually annihilated *in the conflict* of overcoming the *great cohesive power* of ice, yet be partially so, and reduced to 50° or 60°, or less. When one force in animal bodies overcomes another, we always find a diminution (though temporary, because life can regenerate force) even in the conquering force, as when a weight (for instance) is raised by nervous power. Again—when a ball in motion impinges against one at rest, much of the motion is, no doubt, transferred, but surely some must be actually *annihilated* by the act of having overcome *the resistance* of the ball previously at rest.

If 140° were given out by the freezing of water, there should be *some* elevation of the temperature in the contiguous portions of water, since this conducts *even high* degrees of heat slowly, as the experiment of heated water at the top of a glass tube shows. But nothing seems clearer than that there is not.

In Professor Tyndall's late experiments (*Phil. Mag.*, Nov., 1858) after 20 minutes' action of Harrison's freezing apparatus, a thermometer, placed two inches deep in the water, was "firmly" imbedded in ice formed from this water (A) at 24°. We find this thermometer gradually SINKING, so that at 1 o'clock it stood at 11°, and at this time another thermometer put one inch from the side of this, and hence further from the side of the ether (which was in the middle), worked only 26½, and was soon surrounded by ice! (B)*

But why only 26½ if 140° had been given out by the layer of ice *firmly* frozen (A)? Perhaps against all this it may be said that the ether carried off these 140°; if so, still surely even a *small part* should have been given out on the *side of the water*. But on the contrary we find this (B) only 26½, though in *immediate contact* with the freezing water. In these experiments again, then, the common argument that ice freezes so *slowly* does not apply, for the water froze in twenty minutes, and hence the 140° should have been given off very quickly.

Although it seems proved that ice in melting absorbs 140°, and renders the heat "latent" (I should rather call it combined heat which loses its character, just as an alkali does when combined with an acid), still it may be asked (if not annihilated or converted to other force), do not these 140° *gradually* go out of the water as radiant heat? That the intense attraction of ice for heat *continues* after its liquefaction seems doubtful, seeing that nature is against the formation of ice, this being inimical to vitality. Hence there is probably what may be called a *latent nisus* in this ice to absorb heat, and to change to water, and this intense attraction for heat in ice would go to confirm the assertion in the last note, of its being properly considered colder than ice-cold water.

I query whether more than the mere surface (of a few inches deep) could ever freeze if 140° had to be given off, since though these 140° could be easily supposed to be given off directly into the air at the *surface* freezing, still after this was frozen, another 140° would have to ascend through this surface ice, as heat must be conducted away upwards! Such *free* heat, therefore, would immediately thaw the surface that had been frozen?

This heat *must* pass upwards, because it would be attracted by the part where the greatest cold was, viz., at the surface, which being 32°, the next would be 33°, 34°, 35°, 36°, 37°, 38°, 39°, and 40°, the greatest density of water in succession. This water at 40° would constitute a vast dense mass in all freezing water.

Add the reason above stated in favour of my opinion—that water being so bad a conductor of heat, part at least of these 140°, if disengaged, should remain a very *long time* sensible to the thermometer.

Another point in reference to the present subject is, that Sir J. Leslie, in his essay "On Heat," puts down the radiating power of water 100°,† making it somewhat greater even then lamp-black.‡ In consequence, as soon as ever the air becomes colder than freshly melted ice, this will surely soon radiate at *least some* of the 140° it has absorbed to become water. The question is, cannot it do so, and *yet remain water?* If it can—cannot it lose ALMOST ALL these 140°, and still remain water?* That when at 212° it can lose 140° and yet remain water at 72° is certain. Ditto that when at 172° it can lose *even more* than 140°, and *yet remain water;* since, as already stated, Professor Thomson was able to prevent the formation of ice even when water was cooled to 5°.

(To be continued.)

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* Moreover, the *high* degree of heat used for the fusion of these metals renders these cases not so analogous with the expansion of ice as might appear at first sight. The cooling of these metals, too, is also, of course, a far higher temperature than the cooling of water to form ice. In the expansion of this latter, then, we are perhaps always obliged to remember the *final* cause; for if we take cases more analogous, as oil, &c., &c., &c., we find contraction in the *vast* majority of cases examined always to accompany congelation.

† Even the actual giving out of 10° when water at 22° freezes, seems not incompatible with the annihilation of much heat, or its conversion to *pure* repulsive force, during the *expansion* of freezing. In almost every case this causes cold, so that as Leslie produced very great heat by forcing air to condense suddenly in the void, so he produced cold enough to freeze mercury by the *sudden* separation, and of course to a *greater extent* than can happen in common circumstances of the atoms of air by rarefaction.

* In another Essay on Heat I shall have occasion to say more on these experiments; at present I may state that they in *one* sense seem to support M. Person's opinion quoted by Prof. Forbes, that "ice is essentially colder than ice-cold water," (*Compt. Rend.*, 1850) since they show that the interior of masses of ice was often below 32°. But we know that ice *water* never can, *in common circumstances*, get below 32°, and if in Thomson's experiments "*once* to 5°," we know that ice *might* be cooled to any possible degree and yet remain ice.

† See also Thomson, *On Heat*, p. 25.

‡ This great radiating power will also support my opinion (above-stated), viz., that if 140° are given out by freezing, *at the very least* 10° or 12° should be indicated by a thermometer placed *in the air* above the water becoming ice.

* If these 140° are ever given out again this is the only possible way, and very different from what Dr. Black, Thomson, and Wilson supposed, for it is obvious that on this theory these 140° will not be necessary for fluidity, though they are for the *melting of ice* certainly. Suppose only 10° remained to be given out in the act of congelation, our thermometer possibly might not be able to detect them. When air is at 22°, it certainly must be *long gradually* extracting heat from water.

ON THE RELATIVE EFFECTS OF DENSE AND SUPER-HEATED STEAM.

By Mr. THOMAS HOWARD.

IN my communication to the MECHANICS' MAGAZINE of 14th February, 1857 (No. 1749) on the subject of super-heating steam, I ventured to remark that "it would seem probable that the system may shortly pass into the competing hands of the makers of steam-engines, without which condition there would be little hope for it even now." It has just arrived at this position, and would seem on the fair road of becoming generally adopted. The exposition too therein given of the loss of steam, and of course of fuel, by the precipitation of water on the internal surface of the cylinder and its adjuncts on the admission of dense steam, such surface being cooled by the rapid conversion into vapour of this water on communication with the condenser, and so on alternately, is beginning to be accepted and understood; as is also the prevention of this loss by simply giving to the steam "a sufficient surcharge of caloric to enable it to maintain its elastic or vaporous condition throughout the stroke without the deposit of water."

I now record in further confirmation of these views the result of many experiments made in the interim on the four steam-engines at these works. Two of them are fitted with jackets to which the steam is admitted from the boilers at its full pressure, and the condensed water drawn off as it accumulates. One of them, without a jacket, is provided with a vessel to catch the condensed water passing along the steam-pipe, which is of considerable length. The other has neither a separator nor jacket, but the steam pipe is thoroughly clothed. The boilers are large and have plenty of steam room, and being worked by the spare heat of the reverberatory furnaces, are not subject to forcing or priming. The nominal powers of the engines are 45, 25, and two of 20 horses. I inserted into the cylinder cover a small cup or thimble projecting a little way into the cylinder, and containing sufficient mercury to cover a thermometer bulb. A hole was also drilled nearly through the valve case close to the port, also supplied with a little mercury.

The engines are low pressure and condensing, the pressure varying from four to nine pounds per inch above the atmosphere. Care was taken to have the piston packing and slides duly tight at the time of the experiments. A pressure indicator of the usual construction was applied simultaneously with the thermometer.

The result of the experiments is, that when the engines were working about one-fourth below their assigned velocity under heavy loads, and the throttle valves wide open in order that very little difference of pressure should exist between that in the cylinder and steam-pipe, the temperature of the former at the least was 17° below that of the latter. And when the engines were worked at their assigned velocity of 200 feet speed of piston per minute, the difference of temperature reached 20°. The steam is not worked expansively more than by the ordinary lap of the slides, as there is an abundant supply, and this may be nearly balanced by the cushion of steam at the end of the stroke. The diminution of temperature as shown by the above discrepancy, owing to a

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diminution of density of steam in the cylinder (here by the indicator nearly two pounds per inch), from rapidity of motion of piston, or it might be by partial closing of the throttle valve in other cases, must not, should these experiments be repeated, be confounded with that otherwise arising, or a greatly exaggerated result will be apparent; in short, by so much as is due to the rarefaction, as I found on trial. The experiments were conducted with the hot cistern at about 100°, and a vacuum of nearly 28 inches when the barometer was at 30 inches. The thermometer was much influenced by the state of the condenser vacuum varied occasionally for the purpose. The water in the hot cistern was sometimes permitted to become so hot as nearly to stop the motion of the engine when the cylinder thermometer rose to nearly the normal temperature of the steam; but on restoring the injection it presently fell to its former point.

Now, the steam pressure in the average of the experiments was six pounds per inch, the temperature due to which is 227°, and the temperature of the interior of the cylinder was at the highest 17° less, falling to 210° on the mean; and as dense steam cannot exist for an instant in contact with a surface at a temperature lower than is due to its pressure without a corresponding deposition of water and loss of heat of conversion, it will be found on consulting tables of steam pressure, that the above denotes a loss of between one-third and one-fourth.

It then occurred to me that this might be further tested by stopping the engine at the dead point, and then admitting by a momentary opening of the induction valve, a cylinder full of steam at a certain pressure, and noting the effect on the indicator; and I found when this was aptly done the fall closely followed the thermometric deduction. Some loss must here take effect unperceived however. But tried on smaller parts of the stroke when the plenum can be more rapidly produced and cut off, the decadence was almost immediate and in accordance to the full with the thermometric result. On the whole, I cannot estimate this loss by deposition (in the cylinder) at less than one-fourth of the steam.

With respect to the loss by radiation on the naked cylinders, as shown by the subsequent decline of the thermometer, it certainly did not amount to a thirtieth part of the former loss measured by the comparatively tardy declination.

At first sight it might appear very improbable that so considerable a deposit of water can occur in the cylinder as is due to a loss of one-fourth of the steam that enters it at every stroke from the boiler, but a little calculation will show that in a cylinder of a hundred horses nominal power, as an example, the interior surface, including the top and bottom, the piston and rod, the slides, ports, &c., alternately acting, will demand for such effect a film of water of only one-sixth-hundredth of an inch in thickness, if the average steam pressure be one atmosphere, and about one-three-hundreth if of two or say nearly twenty pounds per inch on the safety valve, allowing for some expansive action, &c.—a common pressure for modern marine engines. And at the existing temperature under nearly a vacuum the evaporation of such film will be abundantly rapid.

And now I must state that I could not discover in the jacketed cylinders any material mitigation. Presuming this inertness of the jacket to be due to its comparatively slow conduction compared with the rapidity of stroke under the small differential temperature of about 20°, I found such fully confirmed by experiments on iron plates of the thickness of the cylinder. As the heat will be transmitted in a geometrical ratio under more favourable conditions, as in the Cornish expansion engine, for instance, the result may then be more marked. The piston and rod, the valves, ports, &c., within, and generally the top and bottom of the cylinders remain, however, little affected. Further, the jacket but ameliorates the loss at the expense of the boiler; it might enable a certain size of cylinder to do more work, but a corresponding saving of fuel may not follow.

It is, I think, worth inquiry as to whether Watt was cognizant of this veiled loss of steam by deposition. I cannot find that he was. On the contrary he makes it the essence of his patent for separate condensation that the cylinder is thus maintained at the heat of the steam acting within it. This is further promoted by cutting off external radiation by jackets, &c. But the end designed was certainly not attained, notwithstanding the vast improvement over the old method. Neither do his annotators seem aware of it. Nor does Tredgold, in his standard work on the steam engine, allude to it. The invention and use of the pressure indicator probably led Watt and his compeers away from the necessity of applying a thermometric one. And indeed the latter on an instant acting principle is yet a desideratum, for the mercurial thermometer is of too slow a character to present us with other than an average indication. It may be that its range would mark greater differences. It should here be noted that I always found the mercury in the drilled hole near the port several degrees below the other.

We will now proceed to the subject of superheating the steam. It is remarkable that its resuscitation is chiefly due to what I believe to be an entirely erroneous idea respecting it, viz., that the great portion of the effect derivable from it is the result (under Mr. Wethered's patent) of mixing it with dense steam. I do not hesitate to express my conviction that no gain of power whatever is thus obtained over that of the super-heated steam alone, and that the experiments related of some trial engines in America and France have led to unsound deductions. There may be a convenience, however, in sometimes adding a little of the dense steam in order to reduce the temperature of the surcharged steam if carried so high as to carbonize the packing, if not metallic, and the lubricating material.

We have noted how a loss of fully one-fourth of the steam arises when at a density due to its temperature. Now, when a surcharge of caloric is given to such steam, a considerable reduction of temperature may occur without deposition of water; in fact such steam is in the condition, to a certain point, of a permanent gas, and will pass off into the condenser, or in high pressure engines into the atmosphere, with very little cooling effect on the cylinder, and without the ill consequences related. Yet it will ultimately condense with fully the same rapidity as dense steam, and with better result, since the surface of the cylinder being dry will not be giving forth steam from deposited water, and by so much too will the injection, air-pump, &c., be relieved. But there is a further saving derived from super-heating steam, namely, the increase of volume obtained by means of a portion of the heat otherwise lost in the uptake or funnel. If 100° of surcharge be added to dense steam say of two atmospheres pressure (15 pounds on safety valve), we have 250° + 100 = 350°, and if 20° of this is abated in the cylinder then 330°, a moderate temperature and below carbonization remains. The added 80° will now increase the working volume as 80° to 460°, equal about one-sixth, and thus the practical saving is brought up to quite one-third of the fuel. Probably some mischief has been done to the adoption of super-heated steam by the non-comprehension of what good effect a limited surcharge produces, and extravagant expectations from high and damaging temperatures.

But before the entire advantage will be derived from the super-heating of steam, the expansive action in marine engines especially should be made the rule and not as now the exception, either (to bring up the full power) by enlarging the diameter of the cylinder or increasing the pressure in the boilers, or a combination of both; and surely it is now time that taking the power of engines by the diameter of the cylinder only should at least be modified, so as not to stand in the way of such improvements, and permit a large extent of expansion without the need of a corresponding increase of pressure. Some engineers seem to think there must be much saving in steam of high, over low, or moderate pressure; I really doubt if there be any advantage save that of causing a fixed size of cylinder to do more duty than otherwise. Now if a certain assigned rate of expansion be determined, and the boilers be under regular firing calculated to supply and super-heat the needed steam, and only such variations be occasionally had recourse to on either side of such rate, in conformity, in marine engines, with the requisition of the vessel, as under sail or adverse wind, the super-heating would be equable, and its full advantages, under expansive action, made available.

I doubt not that with such arrangements, and the more so if aided by a system of condensation returning nearly the same water to the boilers, they might be boldly reduced one half, fire grate, funnels, and other appurtenances following; and a saving of quite half the consumption of fuel, and the labour and charges incident thereto, might without difficulty be attained.

It has happened singularly enough that almost the first marine engines to which the system of superheating has on its revival been applied, and the first of the General Steam Navigation Company's fleet, are those now in one of their vessels (of about 110 horses nominal power), which were worked with superheated steam in accordance with my design more than twenty years ago, and so far as relates to it with perfect success. The surcharging was achieved as at present, though under a different arrangement, by the spare heat of the fuel after vaporising the water, which was applied to a surface of about two square feet per nominal horse-power (the actual power is greater in these days and requires more surface, accordingly it may be three to four feet), and the temperature of the steam was 350°. The pressure was 10 pounds per inch, four pounds being at that time the customary pressure, worked expansively by three adjusting cams actuating the throttle valve, fitted for the purpose, and the assigned admission was rather under half the stroke. These engines were removed from the Columbus paddle wheel barque intended to make the first steam passage to America, and which was the third vessel, the Government steamer Comet having been the first and the Vesta private vessel the second, in which the superheating was used (besides an experimental engine of 10 horses power constructed at these works), in conjunction with my process of local vaporisation and of condensation by the re-injection of the same water. The superheating, the expansive action and the circulating condensers were perfectly successful in all these instances. Unforseen difficulties, however, prevented the accomplishment of the method of vaporisation, and adverse concurrent events, among others the successful voyage of the Great Western and the introduction into navigation of tubular boilers, led to the relinquishment of the enterprise. The saving of fuel was one-half and upwards, and I am convinced may again be reached by the means I have before-mentioned.

King and Queen Iron Works, Rotherhithe.
December, 1859.

A NEW ARTIFICIAL LIGHT.—An improved form of the lime light originally experimented upon by Captain Drummond, some years since, was shown by Sir Charles Bright in the Exchange Newsroom, Liverpool, on Saturday last. No substantial improvement has been made in artificial lighting since the introduction of gas at the commencement of the present century; and steadiness, continuity, and diffusiveness of the new light, as well as its enormous power, were fully shown. A single jet of the improved lime light is estimated as equivalent to 40 Argand, or 80 fishtail burners, each consuming five cubic feet per hour, or to 400 wax candles of four to the pound, and its power, unassisted by a reflector, was stated to be 40 times greater than the present oil lamp; and for coast lights, under the same circumstances, should the light be as economical and capable of as easy manipulation as it was on this occasion, there can be no doubt it will effect a considerable change in lighting of crowded places, where the present system of extracting the oxygen requisite for respiration from the air is so objectionable.—*Times*.

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MURRAY'S PATENT IMPROVED CHAIN PUMPS.

FIG. 1.

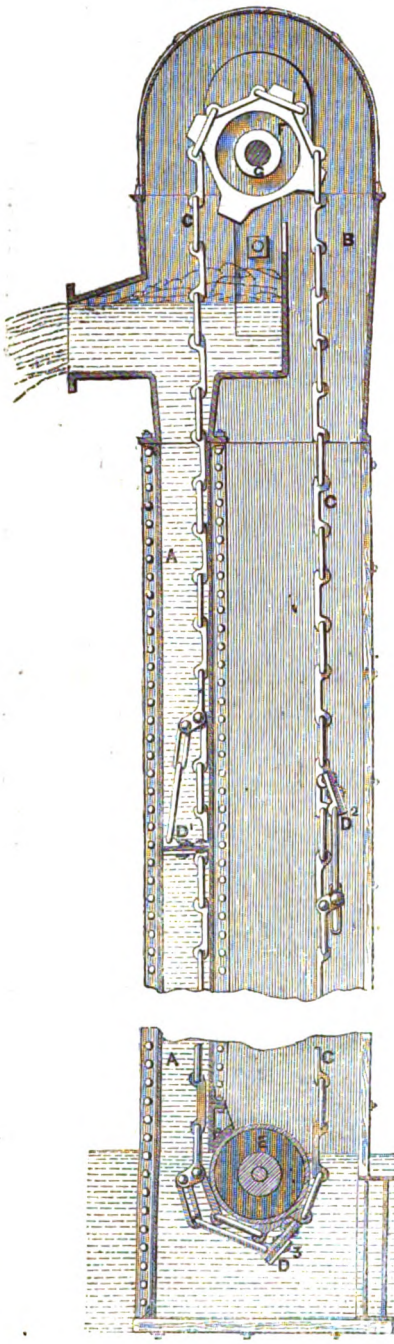


FIG. 3.

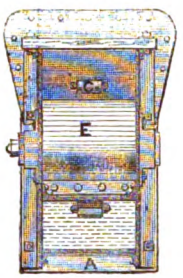
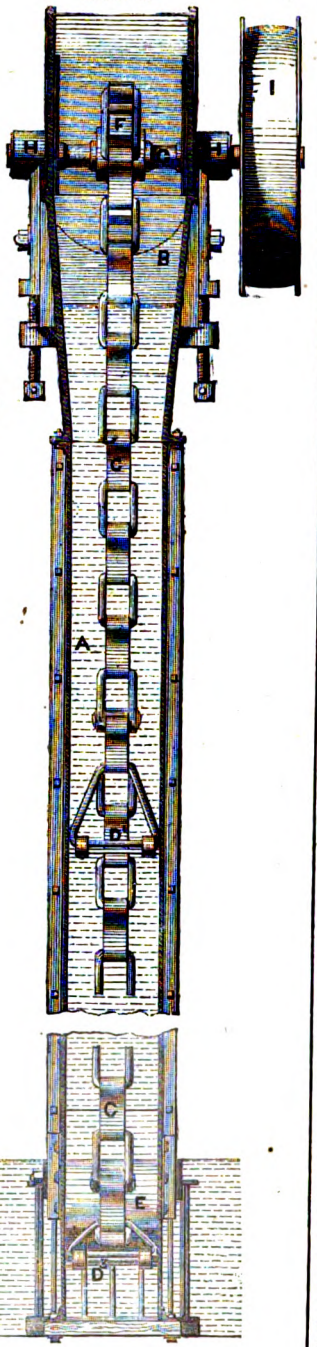


FIG. 2.



MR. MIDDLETON, engineer, of Loman-street, Southwark, is manufacturing an improved chain pump (patented by Mr. Murray), which has been employed and given great satisfaction at the sewer at Whitehall-place and at other places under the Metropolitan Board of Works, in the Royal Arsenal, Woolwich, for various well-sinking purposes, and for numerous other contract works. These pumps, which in some cases have double chains, can be made to lift any quantity and to any height. The chains are of great strength and durability, the links being steeled, as are also the bearings of the chain pulley spindle, so that whatever grit or sand may be washed up, it will not have any effect on the working parts. They are suitable for contractors' use in the formation of docks, tunnels, coffer-dams, sewage works, &c., or for the drainage of marshes, lakes, &c., in the reclaiming of land or for irrigation, and in the Colonies, where steam power might not be accessible, they can be driven by cattle. Two of these pumps have been employed by Messrs. Baker and Son at the Extension Works of the Grand Surrey Docks; one of them has been at work day and night for the last nine months, and the other since June last. A Murray's pump of this size, viz., 27 in. × 9 in., will lift 2,100 gallons per minute, or 126,000 gallons per hour, or equal to 8 pumps of 15-inch diameter and 2 feet stroke, if making 20 strokes per minute; that is, supposing the 15-inch pumps are all doing their full amount of duty, which scarcely ever happens in practice, as the smallest defect in a valve, or bucket, or any impurity in the water, keeping the valves off their seats, causes very considerable loss—frequently more than one-half. Murray's pump, on the contrary, will always do duty in proportion to the speed at which it is driven, and which can be varied to a much greater extent than the common pump, without running the risk of breakage or derangement.

Figs. 1 and 2 of the annexed engravings represent vertical sections of a single chain Murray Pump. Fig. 3 is a plan or horizontal section of the same to a scale of ¾ inch to the foot. *A* is the barrel; *B* the head of pump; *C* the chain; D^1 one of the lifts ascending; D^2 one of the lifts descending; D^3 one of the lifts folding round; *E* the bottom roller; *F* the chain pulley keyed on; *G* the pump spindle and running in; *H H* the two carriages or bearings, on the outer end of which the spindle is keyed; *I* the rigger, which by means of a strap is driven from another rigger on the engine-shaft. It will be seen that the parts are few and simple, and as no clacks, valves, or packing are required it is almost impossible for the pump to choke up or get out of order. The pump never requires charging to obtain a vacuum, for after the first turn of the chain a vacuum is formed under the lift.

PROFESSOR THOMSON'S CENTRIFUGAL PUMP.

ON A CENTRIFUGAL PUMP WITH EXTERIOR WHIRLPOOL, CONSTRUCTED FOR DRAINING LAND:

Read by PROFESSOR JAMES THOMSON, of Belfast, before the Institution of Engineers in Scotland.

THE centrifugal pump which forms the subject of the present communication has been designed and constructed in the course of this year for Messrs James Ewing & Co. of Glasgow, for the drainage of lands belonging to them in Demerara.

The cultivated district of Demerara in which the lands referred to are situated, forms a narrow strip or belt of low ground extending along the sea-coast. It is about four or five miles wide, as measured from the sea back towards the interior. It lies generally below the level of high tide; and is protected in front against the waters of the sea and in rear against the waters of the Savannahs, or inland swamps, by embankments. The district was originally embanked and reclaimed by the Dutch, and was taken from them by the English in 1796, along with other parts of what now forms British Guiana. The drainage is ordinarily effected by valves or kokers, as they are designated, which discharge to the sea when the tide is low, but hinder the entrance of the tidal water when it rises. Of late years banks of soft and shifting mud, or slob, have been gathering and increasing for great distances out to sea, for miles perhaps, in front of some of the estates. These banks, by stopping the drainage outlets to the sea, have caused several estates to be swamped, and have been threatening like destruction to others. Some estates, it is understood, have been saved, mainly by the employment of centifrugal pumps, driven by steam power, which keep up the drainage when the slob rises so high as to stop the ordinary flow to the sea by gravitation through the valves or kokers; and which, by keeping up a run of water over the slob, tend, as is believed, in a material degree to keep open the outlet channels through the slob, or to open them again when choked up by the shifting of the mud banks. Some of the estates of Messrs. James Ewing & Co., after having been seriously threatened for several years by the approach of mud banks to their front, were last year partially injured by deficient drainage; and thus the proprietors were led to determine on speedily procuring a centrifugal pump, to be driven by a steam-engine already existing on their land, as the driving power for one of their sugar mills. They engaged the writer to prepare the designs according to an improved arrangement, which had been devised by him for increasing the work done by a given power, the main feature of which is the employment of an exterior whirlpool round the circumference of the pump wheel. The exterior whirlpool had been previously introduced in a centrifugal pump designed by him in 1853, for Messrs. James Ewing & Co., for drainage of lands on an estate of theirs in Jamaica, and constructed by Messrs. W. & A.

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PROFESSOR THOMSON'S CENTRIFUGAL PUMP.

FIG. 1.

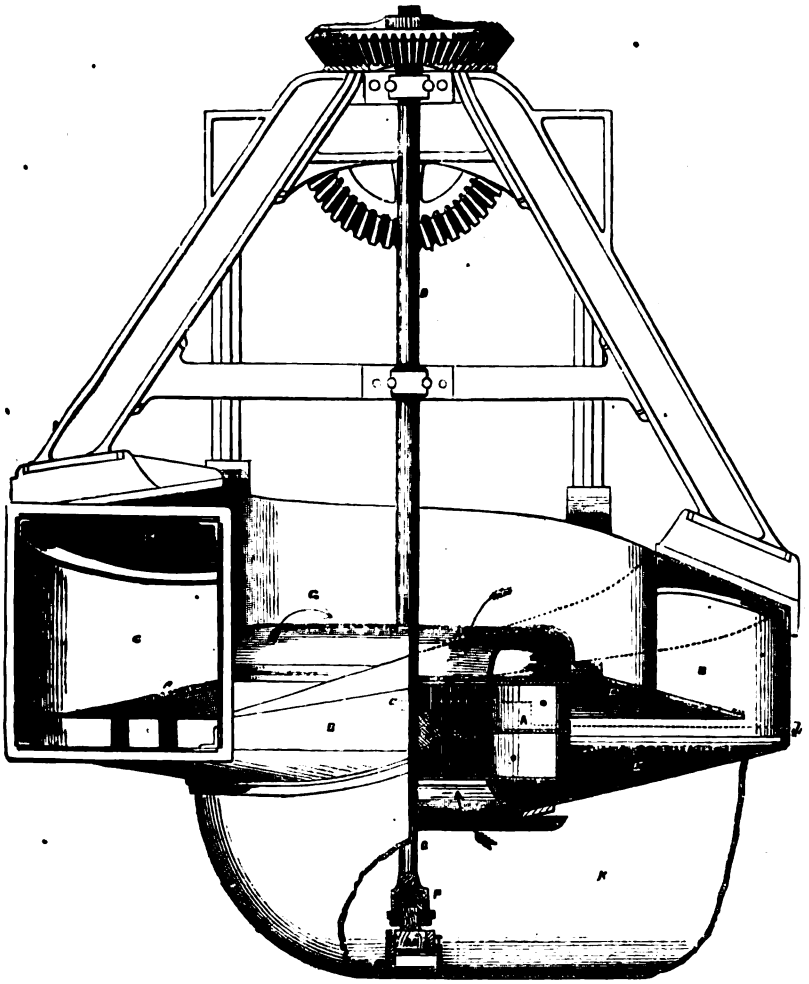
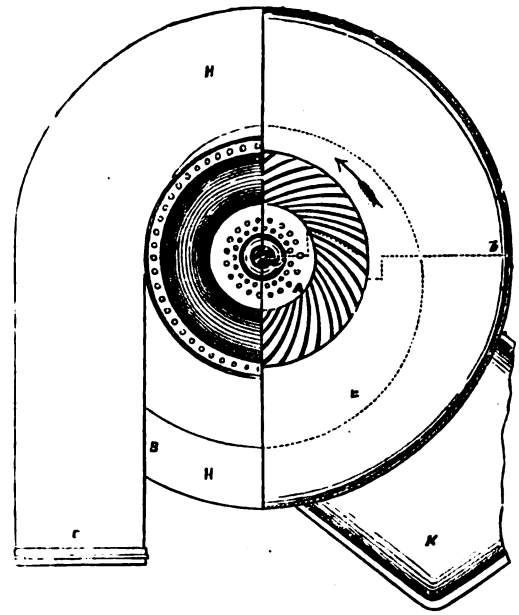


FIG. 2.



M'Onie and Co., of Glasgow. It had also more recently been introduced in a centrifugal pump constructed according to his designs by Messrs. Robert Napier & Sons for a steamer for the Great West of Scotland Fishery Company.* The nature of this modification in centrifugal pumps, consisting of the introduction of the exterior whirlpool, may be understood from the following explanations:—

In centrifugal pumps for water, or fans for air, when doing actual work in lifting the fluid, or in forcing it against a pressure, the fluid has necessarily a considerable tangential velocity on leaving the circumference of the wheel. This velocity in wheels in which the vanes or blades are straight or radial, is the same as that of the circumference of the wheel; in others, in which the vanes are curved backwards in receding from the centre, it is somewhat less; but in all cases it is so great that the water on leaving the wheel carries away, in its energy of motion, a large and important part of the work applied to the wheel by the steam-engine or other prime mover. This energy of motion in centrifugal pumps and fans, as ordinarily constructed, is mainly consumed in friction and eddies in the discharge pipe, which receives the water or air directly from the circumference of the wheel. The object of the introduction of the exterior whirlpool is to prevent this waste, and to apply usefully, towards increasing the pumping power, the energy of the motion inherent in the fluid on its leaving the circumference of the wheel. For this purpose there is provided, round the circumference of the wheel, an exterior chamber, in which the fluid is left free to revolve, in virtue of the motion it had on leaving the wheel. This chamber may be called the exterior whirlpool chamber, and its diameter is ordinarily made about double that of the wheel. The fluid revolving in it assumes the condition of a vortex or whirlpool, which has been designated by the writer as the vortex or whirlpool of free mobility. The principles of the motion of this kind of whirlpool, and of its application in improving the action of centrifugal pumps and blowing fans, was first brought forward at the Belfast meeting of the British Association in 1852, in a paper read in the mechanical section, of which an abstract is to be found in the report of the meeting. The chief properties for which this whirlpool is remarkable are, that its particles move with velocities inversely proportional to their distances from the centre or axis of rotation, and that each particle composing it is free to move to any position within the whirlpool, without interfering with the general motion of the other particles, as each one in moving towards or from the centre assumes of itself, subject simply to the laws of motion under a central force, the velocity due to its position in the whirlpool. It is also a property of this whirlpool that, for any equal particles, in whatever situations in it they may momentarily be, the sum of the energies corresponding to velocity, to pressure, and to height is constant. Thus it arises that, in the exterior whirlpool in the pump for raising water, as each particle of water in moving from the centre, gives up its velocity according to the law of motion already stated, it either actually ascends or becomes subject to a pressure capable of causing it to ascend through a height corresponding to the energy deducted from its motion. It follows, therefore, that through the medium of the exterior whirlpool a decided increase in the working efficiency of centrifugal pumps is attainable; the work contained in the rapid motion of the water leaving the wheel, which, in centrifugal pumps as ordinarily constructed is wasted, being, according to the new arrangement, usefully employed in increasing the pumping power of the machine.

To arrive by a simpler method than that just given at a general idea of the mode of action of the exterior whirlpool in improving the efficiency of the centrifugal pump, it is only necessary to consider that the mass of water revolving in the whirlpool chamber, round the circumference of the wheel, must necessarily exert a centrifugal force, and that this centrifugal force may readily be supposed to add itself to the outward force generated within the wheel; or, in other words, to go to increase the pumping power of the wheel. The outward force generated within the wheel is to be understood as being produced entirely by the medium of centrifugal force if the vanes of the wheel be straight and radial; but if they be curved, as is more commonly the case, the outward force is partly produced through the medium of centrifugal force, and partly applied by the vanes to the water as a radial component of the oblique pressure, which, in consequence of their obliquity to the radius, they apply to the water as it moves outwards along them. On this subject it is well to observe that while the quantity of water made to pass through a given pump with curved vanes is perfectly variable at pleasure, the smaller the quantity becomes the more nearly will the force generated within the wheel for impelling the water outwards become purely centrifugal force, and the more nearly will the pump become what the name ordinarily given to it would seem to indicate—a purely centrifugal pump. When, however, a centrifugal pump with vanes curved backwards in such forms as are ordinarily used in well-constructed examples of the machine, is driven at a speed considerably above that requisite merely to overcome the pressure of the water, and cause lifting or propulsion to commence, the radial component of the force applied to the water by the vanes will become considerable, and the water leaving the circumference of the wheel will have

* See *Transactions of the Institution of Engineers in Scotland*, vol. i., p. 90.

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a velocity less than that of the circumference of the wheel in a degree having some real importance in practice. It has, indeed, been promulgated in respect to some centrifugal pumps with curved vanes brought into use in the last six or eight years that they are capable of propelling the water from the centre to the circumference along the line of a stationary radius, and discharging the water at the circumference without rotatory velocity. This supposition need only be mentioned as being fallacious. A motion approximately along a stationary radius may no doubt have been attained when the pump was made to impel a fluid against no resistance; but when a pump is actually doing work in raising water, the rotatory motion of the water on leaving the circumference of the wheel is unavoidable. In practice it involves in ordinary pumps an important loss, the loss being commonly about as much as the entire power usefully applied in overcoming the gravitation of the water; and the efficiency of the pump comes out, therefore, when friction and other farther losses are taken into account, in ordinary circumstances, considerably less than fifty per cent. of the applied power.

From calculations relative to the various sources of loss occurring in centrifugal pumps of the improved kind with the exterior whirlpool, according to the design carried out for Messrs. James Ewing and Co., the writer thinks the efficiency of such pumps may be fairly estimated at about seventy per cent. Now, the steam-engine, already existing on the estate for which the pump forming the special subject of the present paper was required, is estimated as being capable of applying 25 horses power (of 33,000 foot-pounds per minute) to the driving of the pump. The lift of the water is intended to be variable, according to the state of the weather, and is to range ordinarily from 2½ feet to 5 feet. Then for a 2½ feet lift, and an assumed efficiency of the pump of seventy per cent., the quantity of water lifted comes to be 3,700 cubic feet per minute. And for a lift of 5 feet the quantity would be about half as much, or say 1,850 cubic feet per minute.

The details of the constructive arrangements of the centrifugal pump are shown in Fig. 1. prepared from drawings supplied to the Institution by Messrs. W. & A. M'Onie & Co., the engineers by whom the execution of the work has been carried out. In reference to them the writer here wishes to recognise the very efficient aid they afforded him during the progress of the work in arranging many of the practical details of the construction. The work was required to be designed and executed in great haste, and their ready co-operation tended very materially to facilitate the business of the undertaking. Fig. 1, is an elevation, and Fig. 2 is a (reduced) plan of the pump—one-half of each figure being in section—Fig. 1 as through the line *a b* in Fig. 2, and Fig. 2 as through the line *c d* in Fig. 1. In addition to the description already given of the principles and mode of action of pumps of this kind, attention may be directed to the helical outlet chamber *B C*, which is arranged for receiving the water from all parts of the circumference of the whirlpool chamber, except the part from which an immediate outlet into the discharge pipe is available. This helical chamber has a gradually increasing area to meet the regular accessions of water which it receives from its commencement at its smaller extremity, *B*, forward to its termination at *C* in the outlet pipe. This helical outlet chamber is arranged with a large part of its capacity lying nearer to the axis of rotation than the edge of the whirlpool chamber cover, *D*. This arrangement is made with the special object in view of preventing eddying water that will exist in the outlet pipe at times when the pump is raising a small quantity of water through a high lift, from being able to return to the circumference of the whirlpool, with the risk of breaking through the water of the whirlpool, and, as it were, falling in towards the centre in consequence of having less rotary motion, and, therefore, less centrifugal force than the water of the whirlpool. If any such return water were to penetrate into the whirlpool, it would very materially damage the action of the whirlpool, by disturbing its motion and introducing impacts of quickly moving against slowly moving water. The helical chamber, as may readily be seen by consideration of the figures, is adapted for receiving any such eddying water, and hindering it from getting access to the whirlpool; as the most rapidly moving water coming direct from the whirlpool will tend always to fly outwards, and will occupy the outer parts of the helical chamber, leaving the inner parts of the same chamber for the dead or eddying water, when from any of the varying circumstances of the height of lift and power applied such eddying or dead water exists.

The writer would farther direct attention to the peculiar adaptation of the forms selected for the various parts of the case for the attainment of a high degree of stiffness for preventing the top and bottom of the case from changing their distance apart under varying circumstances of the internal water pressure. It is to be observed, on this point, that no tie bolts through the case for holding the top and bottom together are admissable, as any such tie bolts would interrupt the revolving motion of the water. Yet at the same time, there ought to be as close a fit as possible, without rubbing, between the joint rings of the wheel and case at the central orifices, in order to prevent leakage and waste of the water pumped. The conical forms of the bottom, *E*, and top, *D*, of the whirlpool chamber, and the cylindrical vertical walls, *G*, with the somewhat conical form of the roof, *H*, of the helical chamber, all taken together, and, in conjunction with riveted boiler-plate as the material, form a shell of peculiar stiffness. The chief difficulty connected with this undertaking has had reference to the transmission by sea and land of so bulky a thing as the boiler-plate casing, which is 16 feet in diameter, and which could not well be sent in parts, to be put together at the site where the pump is to work. The casing, was, of course, sent separate from the *boat*, *K*, or large conduit for leading to the water the lower central orifice, *L*, and the casing was shipped on deck, being too large to enter the hold of the vessel by which it was transmitted. Accounts have been received of the safe landing in the colony of these bulky parts; and news is soon expected of farther progress having been made towards their erection at the site where they are intended to operate.

It may be mentioned that the pivot, *M*, on which the wheel, *A*, turns, is made of lignumvitæ. It is fixed standing upright in the bottom of the boat, *K*; and in the bottom of the shaft, *Q*, there is fixed a brass socket, *P*, which turns on the pivot. Arrangements are made for spreading an ample supply of water over the rubbing surfaces of the wood and brass, for lubrication. Bearings of lignumvitæ have of late years been found to be much superior in durability, when working under water, to any kinds of metallic pivots. Lignumvitæ, from this reason, has recently come much into use for the bearings of propeller shafts, where the shafts pass through the sterns of steamers. Lignumvitæ pivots have likewise come much into use for turbines in America, and the writer is now in the habit of introducing them in his vortex turbines, in preference to all other kinds of pivots.

In conclusion, the writer considers centrifugal pumps, constructed on the principles which have been described, to be capable of affording the best available means of raising large quantities of water through low lifts, or through lifts of such moderate height as may not require the wheel to revolve at an inconveniently high speed. For drainage of fens, and for raising the sewerage of towns through moderate lifts, they are peculiarly suitable. They are much less liable than common pumps to be choked or injured by the entrance of solid materials; and, having no working valves or pistons, they are remarkably free from injury by wearing; whilst, as regards economy of power in the applications referred to, they will, the writer believes, be found decidedly superior to pumps of the ordinary kinds, constructed with valves and pistons or plungers.

Mr. M'Onie exhibited a model of the pump, and explained the drawings, showing the details of its construction. In reply to inquiries, he stated that the pump was prevented by a timber framing from being shifted by the floating action of the water in which it was immersed. The wheel, *A*, was upon a vertical shaft, and the water had access to it both above and below, finding its way to the top central aperture over the casing of the helical discharge duct, and to the bottom central aperture by the boat, *K*, which formed a channel for it through the mud. The wheel was made with 36 blades, which were about 6 inches apart at the circumference, and 1¾ inches at the central opening; the whole being flush-riveted together, in order that the frictional resistance to the passage of the water should be as little as possible. The pump was intended to work at the rate of about 30 revolutions per minute, but the speed would vary with the lift.

The President thought that a pump of this kind would be very suitable for removing the sewerage of towns where, from the lowness of situation, it was necessary to lift the sewerage in order to get rid of it.

Mr. Hill, of Barlanerk, who was introduced by the President, said he had had much pleasure in listening to the President's address, and to Professor Thomson's paper. He thought that in places like Glasgow, where one part of the town was much more elevated than another, the sewerage of the higher part might, by its descent to a mean level, be made to raise to that level the sewerage of the lower part. Professor Thomson's pump would be extremely well adapted for working out this plan.

The President remarked that the number and closeness of the blades in the wheel might seem likely to cause more friction than was desirable; but he believed that Professor Thomson had carefully calculated the amount of friction, and that he had proportioned each part, so as to obtain from the whole a maximum result. This particular form of pump was suitable for low lifts, and in the present instance the pump had been designed for a lift of from 2½ to 5 feet only. For higher lifts the size would have to be reduced, and the velocity increased, for the application of the same power. He proposed that the thanks of the meeting be awarded to Professor Thomson for his paper, and to Mr. M'Onie for his drawings and model.

The thanks of the meeting were unanimously awarded accordingly.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

We have much pleasure in directing the attention of the young engineers of London and its neighbourhood to the above-named institution. It came into existence in May of the present year, and has already attained for itself a respectable standing among older and kindred societies. Its members are composed, for the most part, of students of engineering — in its civil and mechanical branches — who meet once in each month for mutual edification. After the manner of the Society of Arts, &c., papers are read and discussed on these occasions, the subjects of them being confined to matters scientific. The individual experiences of the workshop and of the drawing office are thus afforded room for expansion, and made the medium of general instruction. The rules of the society have been framed with much care, whilst the yearly subscription appears to have been fixed at as moderate a sum as is consistent with the liquidation of current expenses.

It is impossible that anything but good can result from the establishment of the "Civil and Mechanical Engineers' Society." It will, we venture to predict, become a Preparatory, or *Training* School rather, whence eventually pupils will emerge worthy of following in the footsteps of those great men whose works are every where around us, and who have done so much to make this country pre-eminent in the scale of nations.

The Secretary's address is 26 Arbour-square, Stepney.

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Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

Dec. 13, 1859. — Joseph Locke, Esq., M.P., President, in the chair.

Annual General Meeting.—The report of the Council for the past session, which was read, noticed briefly, in accordance with the usual practice, some of the works in progress, or which had been completed during the preceding twelve months. These we may notice in our next number.

The principal papers read during the session were then noticed, and it was remarked that, though comparatively few in number, they were, in excellence and in variety of subjects treated, quite equal to those of former years. This was evident from the interesting and animated discussions to which they gave rise, occupying about one-half of the entire number of meetings. The members were again urged to make the institution the depository of copies of any public or private reports upon which they might have been engaged, so as to be at hand for reference. The council had pleasure in announcing that Mr. George Robert Stephenson had expressed the intention of presenting the portrait, by Briggs, of the late Mr. George Stephenson; that Messrs. Isambard and Henry Brunel had kindly offered a portrait, by Horsley, of their late lamented father; and that Mr. Joseph Cubitt had promised the portrait, by Boxall, of Sir William Cubitt, Past President. It was hoped that these valuable additions to the collection already upon the walls in the meeting room would induce further contributions, so that the series might be rendered complete. The deceases of the members during the year were announced to have been:—the Earl De Grey, Honorary Member; Messrs. Isambard Kingdom Brunel, Hugh Ebrington Fortescue, William Hartree, Daniel Mackain, Robert Stephenson, M.P., Thomas Storey, and Alexander Wright, Members; James Barrett, Samuel Bennett, Robert Cantwell, George Donaldson, Robert Barlow Gardiner, Edward Highton, John Houldsworth, Edward Hughes, and George Mills, Associates. The resignations of one member and three associates were announced, and it was stated that the effective increase during the year (after deducting the deceases and resignations) amounted to thirty-seven, whilst the total number of members of all classes on the books was eight hundred and ninety-four. It was felt that the loss of two such men as I. K. Brunel and Robert Stephenson could not be adequately estimated. Both had been prematurely removed in the prime of life, and in the vigour of their intellect—the former, on the eve of the completion of one of his gigantic and original conceptions, after successfully combatting great difficulties in the execution of many peculiar constructions—and the other, when it might have been hoped that the practical experience of many years, in the prosecution of great and successful works, would have been rendered useful to his country, in the House of Commons, and as an adviser of the Government, for which he was eminently qualified, not only by his knowledge, but by the uprightness of his character. Among other munificent legacies to public bodies, Mr. Robert Stephenson had bequeathed to the Institution of Civil Engineers the sum of £2,000. It would be for the succeeding council to propose the mode of appropriating the interest of this fund, in such a manner as to connect the name of Stephenson permanently with the Institution. The financial position of the Institution continued to be very satisfactory. There was an available balance of £1,356 (of which £1,000 was on deposit at interest,) being an excess of £300 above the balance of the previous year. The series of Minutes of Proceedings up to, and including the volume for 1857-8, had been completed, by the publication of Vol. VIII., Part 2, and of Vol. XVII. It was stated that the Minutes for the past session would be issued early in 1860. The Council, in resigning their trust, thanked the members for the support accorded to them on all occasions; and asked for their successors the same kind co-operation they had experienced—without which the Institution could not continue to make the progress that had, up to the present time, marked its career.

After the reading of the report, Telford Medals were presented to Messrs. M. Scott, R. Mallett, H. Bessemer, and W. J. Kingsbury; a Watt Medal to Mr. J. W. Jameson; Council Premiums of Books to Messrs. T. S. Isaac and M. B. Jackson; and the Manby Premium, in Books, to Mr. W. J. Kingsbury.

The thanks of the Institution were unanimously voted to the president for his attention to the duties of his office; to the vice-presidents and other members and associates of council, for their co-operation with the president, and their constant attendance at the meetings; to Mr. C. Manby, secretary, and to Mr. James Forest, assistant secretary, for the manner in which they had performed the duties of their offices; as also to the auditors of the accounts and the scrutineers of the ballot, for their services.

The following gentlemen were elected to fill the several offices on the council for the ensuing year: G. P. Bidder, president; J. Fowler, C. H. Gregory, J. Hawkshaw, and J. R. McClean, vice-presidents; Sir William Armstrong, J. Cubitt, J. E. Errington, T. E. Harrison, T. Hawksley, G. W. Hemans, J. Murray, J. S. Russell, G. R. Stephenson, and J. Whitworth, members; and W. Bird and Captain Huish, associates.

The meeting was then adjourned until Tuesday, January 10th, 1860, when the new president would take the chair, and it was announced that the monthly ballot for members would take place, and the discussion upon Mr. Grantham's Paper, "On Arterial Drainage and Outfalls," would be resumed.

THE SOCIETY OF ARTS.

Dec. 14, 1859.—R. Wygram Crawford, Esq., M.P., in the chair. The Secretary called attention to Mr. Ludlow's life-boat (described in a recent number of the MECHANICS' MAGAZINE), and several members were elected. The paper read was on "THE GREAT EASTERN," by William Hawes, Esq. We have brought forward much of this paper in a leading article in another page. We condense the following remarks from other parts of the paper:—To carry out his leading ideas, Mr. Brunel adopted the following dimensions and arrangements as most likely to accomplish the results he desired, viz.:—The length of 680 feet; the length of upper deck, 692 feet; breadth of beam, 83 feet; depth, 58 feet; engines of 2,600 horse nominal power; a midship section of 1,600 square feet, with a capacity of carrying 12,000 tons of coals, a large number of passengers, and 10,000 tons of cargo. The centre of the ship above the main-deck he appropriated to passengers, the space below the water-line to the boilers, engines, and coal bunkers. This space is 350 feet in length, and is divided into three compartments by two substantial bulk-heads running fore and aft the entire depth of the ship. The centre compartment, 36 feet in width, is exclusively occupied by the engines and boilers. The outer compartments are filled with coals. The boiler-rooms are arched over with an iron roof, to prevent the radiation of heat from them into the ship, and also to prevent the escape of smoke, and other unpleasant smells into the cabins above them. This complete isolation of the boiler department from the rest of the ship is quite novel, and is a great security to the passengers against injury from any accident which may happen to them. The remaining 332 feet of the ship is about equally divided fore and aft, and is appropriated to cargo and stores. So much for the basement of the ship. The space immediately above the 350 feet we have thus described is divided into two parts by the paddle engine room, which occupies, including the engineers' and the stokers' berths, a space of 40 feet in length and the entire breadth of the ship, thus separating the first from the second and third class passengers; the first being in the forward compartment and therefore subject to less inconvenience from smoke or dust, as also from any vibratory motion arising from the working of the screw. With this exception there is no real difference, so far as the ship is concerned, in the accommodation of the third, second, and first class passengers. Of course, the fittings of the cabins, the number of berths in them, and the dietary, would be different in the first, second, and third classes. Although almost up to this time every large ship has been looked upon with doubt as to its strength and safety, it is now admitted by all that, whatever may be its other faults, this ship is the strongest ship ever built. In all ships previously built size was the great element of weakness. To the Great Eastern it was a source of strength, for only in a very large ship could all the elements of strength she possesses be combined. The first and most important addition of strength is gained by the cellular construction of the hull and deck. In fact it is a double ship to 3 feet above the water-line, held together by ribs of immense strength, at intervals of 6 feet each, which are united to transverse plates, dividing the entire surface of the ship into spaces of 6 feet square. The next element of strength we find in the two longitudinal bulk-heads, the entire depth of the ship, firmly fastened to the transverse bulk-heads, and thus forming two bars of iron 60 feet high, 350 feet long, and ½ inch thick. The force required to tear these asunder, as well as to rend the double cellular hull, is more easily imagined than described, and is certainly very far beyond any strain which, under known conditions of ocean navigation, can possibly arise. The strength obtained by this arrangement was tested during the launch, when unexpectedly, and for the long period of two months, the ship was supported on two cradles, each 120 feet in length, leaving above 150 feet at each end, and about 100 feet in the centre of the ship without support, and the most careful observation could not detect the slightest change of form. So much for its length. Next, as to its breadth. The cellular construction of the hull is also a source of strength against a transverse strain, but this is more particularly provided for by the cellular upper-deck, and by the twelve transverse bulk-heads, each forming a a plate or bar of iron 58 feet deep, 80 feet long, and half-an-inch thick. These transverse bulk-heads, stiffened by their fastenings to those running longitudinally, and the cellular construction of the hull and deck of the ship, give to the whole a uniform strength which has never before been attained. The strength of the general structure, and its power to resist a transverse strain, was tested in an unexpected manner by the accident which happened during her voyage to Portland. Here was the explosion of a boiler at very high pressure, 30 feet long, and 6 feet in diameter, the force of which lifted the entire chimney, weighing 8 to 10 tons, many feet high, carrying away and overcoming the resistance of all its fastenings, without doing the least injury to the frame of the ship; and it is equally remarkable that the heavy funnel being lifted from the bottom of the ship to several feet above the deck, should fall upon it, and cause but the most trifling damage, so that not only was the general structure or hull tested by the resistance it offered to the lateral force of the explosion, but the strength of the deck was tried in a manner never calculated upon, and both bore these tests to the admiration of every one who has since examined the ship, but especially of those on board, none of whom could, without such experience, have believed it to be possible that a ship exposed to such an explosion could afterwards have carried them, without a moment's delay, safely to their journey's end These, then, are the peculiarities of construction. which have given to this large ship such strength and safety as not only to forbid the idea of increased danger from its great size, but to convey to the mind a sense of security greater than can be afforded by any ordinary mode of shipbuilding, and, from the practical engineering improvements

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over any other large ship yet built. Next let us consider the motive power. Here, taking advantage of experience—appreciating the advantages of the paddle, which are great, and those of the screw, which are equally so, both having drawbacks under special circumstances, and each also possessing advantages calculated to overcome the deficiences of the other—Mr. Brunel determined to apply both, giving the preponderating power to the screw, and singular it was that the advantages of this combination should have been exhibited while the ship was riding at anchor at Holyhead, during the late storm, when the screw, fouled by floating timber, was freed by the gentle action of the paddle, and injury to the paddle floats prevented by stopping the paddle engines and propelling the ship by the screw, thus alternately using first one and then the other, the safety of both being secured by the alternate action and rest of each. It is perhaps fortunate that in so short a time the ship should have undergone three unexpected tests of her efficiency—of her longitudinal strength in the launch, of her lateral strength by the explosion, and of the utility and safety arising from the double motive power at Holyhead, in each case the success being complete. The steadiness of the ship at sea may be, to some extent, attributed to this double motive power, each shortening the interval which would elapse when, by the natural action of the waves, the other would be inefficient. In pitching, if she will ever meet a sea to make her pitch in the ordinary sense of the term, the paddle will be in full action, and so propel the ship when the screw has least power, and in rolling, when the paddles are least effective, the screw will be most efficient. I have not time to notice many minor points of great interest to the engineer and shipbuilder. The absence of external keel—the flatness of her floor—her iron and wooden masts—the application of steam power to aid in many of the ordinary duties of the ship—the situation and adjustment of her compasses, &c., I cannot do more than thus briefly refer to, passing on to the inquiry as to the effect of her great size on the facility and certainty with which she can be navigated. The first difficulty suggested was that of steering. To accomplish this efficiently, it is necessary that the captain should be in a position to command a full view of the ship's course, and to communicate at once with the officer at the helm. The post always assumed by the captain in steamers is the bridge near the centre of the ship; but in this ship it is more than 300 feet from the helm, and, without some mechanical aid, it would be impossible to ensure that immediate obedience to his orders which is indispensable. This aid is afforded by two dials, properly marked, and two indicators, one moved by the man on the bridge close to the captain, awaiting his orders, and the other answering thereto from the helm. The captain directs the man on the bridge to put the helm "hard a-port," and he immediately brings the indicator before him to the proper mark on the dial, moving, at the same time, a corresponding finger on the dial immediately before the officer at the helm. As soon as the finger begins to move, the officer orders the men under him to move the tiller in the same direction, and this action moves the dial on the bridge, showing that the order is in course of being obeyed, almost before it is fully expressed. By this contrivance the orders of the captain are conveyed 350 feet to the officer of the helm, and are obeyed quickly, quietly, and accurately, thus overcoming the inconvenience of distance, and obviating one of the anticipated difficulties of navigating this large ship. At night these dials are illuminated, so that the facility of communication is fully equal to that by day. On either side of this steering apparatus [which is the invention of Mr. Lungley, shipbuilder, of Deptford-green] are the paddle and screw engine telegraphs. Here, by turning a handle with an indicator, working on a marked dial-plate, a similar indicator is moved in the engine-room, every movement being preceded by the sound of a large bell, which can be distinctly heard over the noise of the machinery, and by these arrangements the rudder and engines, although out of sight of the captain, are as immediately under his command as though he could speak to the engineers and helmsman. [The beautiful engine-room telegraphs of the Great Eastern were made and fitted by Mr. Suffield, of Bermondsey-wall.] I am not sailor enough to describe the arrangements for working the sails and rigging, but it is easy to conceive that, with an officer and gang of men to each mast, orders may be conveyed by signal with certainty and precision, and the experience gained at sea, so far, is favourable to the practical efficiency of these arrangements, for the ship invariably answered the helm as certainly and as quickly as any small craft. The next, but perhaps the most important subject for consideration, as regards the safe navigation of the ship, was how to secure, as far as possible, the accuracy of the compass in so large an iron ship, but experience and science have overcome all difficulties, for although the weight of iron in this ship is by several thousand tons greater than that in any other, yet it is so large that the effect of the iron of the ship on the compass of the ship can be as easily, and perhaps more easily counteracted, than in ships of war, or in smaller ships where the compass is more closely surrounded by the iron-work and the armament. Ample means have been taken, by careful adjustment, and in the selection of the positions where the compasses are placed, to prevent if possible any disturbance of the magnetic action, and, if any should occur, to afford facilities for watching and noting such disturbance, so as to prevent any deviation from the intended course. Every one who has been on board during her trial trips testifies to her steadiness. It has been assumed by some, without any reason, that she would neither pitch nor roll, an assumption displaying a want of knowledge of dynamics, and of what is required for the safety of the ship. The waves which would make a Dover packet pitch and roll, as most of us have experienced in crossing the Channel, will produce no effect upon her. Let, however, waves be formed which bear the same proportion to this ship as the waves in the Channel do to a Dover packet, and the pitching and rolling will be equal; but as this, so far as our knowledge goes, cannot be, so will this ship be easier than any other. Thus we find, during the late rough weather, as she came round the Land's End, with a westerly gale driving in the Atlantic rollers, she rolled only to eight degrees, whereas Dr. Scoresby, running round the same course to Plymouth in the Royal Charter, states that off the Lizard the rolling varied from 20 to 30 degrees, and that in a gale of wind in the Southern Ocean, when the ship was running fourteen knots, she rolled 28 degrees to port, and 19 degrees to starboard; and that her rolling on the return voyage from Australia viâ Cape Horn was much greater, the clinometer indicating, on several occasions, an inclination of 33 degrees to port and 28 degrees to starboard, and on one occasion the time occupied by each oscillation was fifty seconds. It can hardly be doubted, then, that with almost an absence of pitching, and rolling so much reduced as in bad weather not to exceed eight to ten degrees, this must be a comfortable ship, and we have a right to regard the superiority of comfort in this over that of any other ship as satisfactorily proved.

Appendix.—Dimensions of the Great Eastern.

Length over all, 692 feet; breadth, 83 feet; depth from deck to keel, 60 feet; number of watertight compartments, 12; partial ditto, 7; longitudinal bulkheads, running fore and aft, from keel to upper deck, at a distance apart of 36 feet, and 350 feet long, 2; space between the two skins of ship, 2 feet 10 inches; thickness of floor plates or keel, 1 inch; thickness of inner and outer skins and bulkheads, ½ inch. Engines. Paddle:—4 cylinders, 74 inches diameter, 14 feet stroke, 4 boilers, 40 furnaces, 1,000 horse-power, paddle-wheels 50 feet in diameter, but capable of reduction by reefing. Screw:—Cylinders, 4; diameter, 80 inches; stroke, 4 feet; boilers, 6; furnaces, 72; diameter of screw, 24 feet; blades to screw, 4; horse-power, 1,690. Weight of ship and machinery at launch, 12,000 tons, immersing 15 feet 6 inches; ordinary light draught, 20 feet; full load, 30 feet; space for fuel, &c., 12,000 tons.

GEOLOGICAL SOCIETY OF LONDON.

Dec. 14, 1859.—Prof. J. Phillips, President, in the chair. J. H. Bass, Esq., was elected a Fellow. The following communications were read:—1. "On some Remains of *Polyptychodon* from Dorking." By Prof. Owen, F.R.S., F.G.S. 2. "On some Fossils from near Bahia, South America." By S. Allport, Esq. Communicated by Prof. Morris, F.G.S. 3. "On a Terrestrial Mallusc, a Chilognathous Myriapod, and some new species of Reptiles, from the Coal-formation of Nova Scotia." By J. W. Dawson, LL.D., F.G.S., &c. 4. "On the Occurrence of Footsteps of *Chirotherium* in the Upper Keuper of Warwickshire." By the Rev. P. B. Brodie, F.G.S.

PHILOSOPHICAL SOCIETY OF GLASGOW.

Anderson's University Buildings, Nov. 2, 1859. The Fifty-eighth Session of the Philosophical Society was opened this evening, Dr. Thomas Anderson, Professor of Chemistry in the University of Glasgow, President of the Society, in the chair. The President, in opening the Session, remarked, that the society had now reached the fifty-eighth year of its existence, and that during the whole of that period it had gradually advanced, both in the number of its members and the importance of its proceedings; and that it now possessed a library of considerable extent, well stocked with scientific periodicals, and calculated to be of much value to its members. He pointed out the great importance of such a society in a city like Glasgow, at a time when the arts and the sciences on which they are founded are every day coming more closely into contact. It is only necessary to watch the progress of the useful arts to feel convinced on this point; for we find that in all those which are most closely related to science a watchful care is exercised to discover and apply every discovery that is likely to prove useful. On the other hand, instances are constantly offering themselves in which, from the neglect of science, particular arts have fallen far behind our knowledge of the theoretical principles on which they depend; and in others, it has required the active interference of scientific men to bring about the practical application of many principles which they have determined. Mr. Edmund Hunt exhibited and explained the "Cinephantic Colour Top," with which he reproduced some of Mr. Rose's effects, and showed a number of new colour experiments. Mr. Hunt was requested by the society to continue his experiments at next meeting.

Nov. 16, 1859.—The President in the chair. Several gentlemen were elected members of the society. Mr. Cockey, the treasurer, gave in an abstract of his account. Dr. Bryce, the Librarian, reported that the library now consisted of 2,930 volumes, exclusive of the English, French, and German Periodicals. The society appointed the following gentlemen to be its office-bearers for session 1859-60:—

President, Professor Thomas Anderson, M.D.; Vice-Presidents, Professor W. J. Macquorn Rankine, LL.D., Mr. Alexander Harvey.; Librarian, James Bryce, LL.D.; Treasurer, Mr. William Cockey; Joint-Secretaries, Mr. Alexander Hastie, Mr. William Keddie; Council, Mr. J. P. Fraser, Mr. George Anderson, Mr. John Condie, Mr. James, Couper, Professor Wm. Thomson, Mr. Walter Crum, Mr. Robert Blackie, Mr. George Smith, Dr. Francis H. Thomson, Mr. Edmund Hunt, Mr. James R. Napier, Professor Rogers.

Professor Willian Thomson submitted to the society a proposal which had this evening been deliberately considered and recommended by the council, that the proceedings of the society should be printed and issued fortnightly, instead of annually, or at longer intervals, as heretofore.

On the CINEPHANTIC COLOUR TOP. By Mr. Edmund Hunt. Mr. Hunt again exhibited the

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Cinephantic* Colour Top, and gave a highly entertaining explanation and description of the experiments, which, we regret to say, we have not space for.

Nov, 30.—Mr. Alex. Harvey, Vice-President, in the chair. G. Blair, M.A., was elected a member of the society.

Professor William Thomson reported that the committee appointed at last meeting to prepare a plan for the fortnightly publication of the proceedings had agreed to a set of regulations, which the society unanimously approved, and then in accordance with them authorised the committee to proceed with the fortnightly publications of the proceedings. The society agreed to take charge of the reports of the comissioners of Patent Inventions, and to make them accessible to the public, on condition of the entire expense being borne by the Town Council.

Mr. David Mackinlay read an account of A VISIT TO ICELAND. In this paper the writer gave an account of a fortnight's journey he had made from Reykiavik, the capital, to the south coast of Iceland, interspersed with many interesting observations on the condition of the country and the habits of the people. On his way Mr. Mackinlay visited Thingvalla and the Geysers; and on his return, the hot springs of Reykum and the sulphur mines of Krisuirk.

MEETINGS FOR THE ENSUING WEEK.

WED.—*London Inst.*, "On the Physical History, Structure, and Materials of the Earth," by E. W. Bradley, Esq., F.R.S., F.C.S., at 7 p.m.

FRI.—*London Inst.*, "On Certain Principles of Vegetable and Animal Chemistry," by F. A. Malone, Esq., F.C.S., at 7 p.m.

RAILWAY BREAKS.

SOME experiments were made last week on the Oxford, Worcester, and Wolverhampton Railway, between Worcester and Evesham, with Newall's, Gasse's, and two other breaks, by Mr. Fay and Mr. Chambers. The experiments were made in presence of Colonel Jolland, the Government Inspector, Mr. Fenton, Chairman of the Oxford, Worcester, and Wolverhampton Railway Company, Mr. Sheriff, the general manager, and Mr. Wilson, the Engineer. There were also representatives present from the Great Western and the Lancashire and Yorkshire Railway Companies. The results of the experiments are said by the *Times* to have been as follows:—On six experiments with Fay's break, at an average speed of 36 miles an hour, the experimental train was stoped, on an average, at a distance of 507 yards. In a second series of experiments with the same break, at the same average speed, the train was stopped on an average at a distance of 795 yards from the place where the break was first applied. Two series of experiments were tried with Mr. Chambers's break. On the first series of six runs, at an average speed of 36 miles an hour, the train was stopped at an average distance of 731 yards; and on the second series, at an average speed of 35 miles an hour, the stoppage was effected at 717 yards. There was some derangement of the break machinery in the first series of experiments with Chambers's break; the experiments with Newall's break were first at an average speed of 36 miles an hour, at which speed the train was stopped on an average at a distance of 900 yards. On the second series, at a speed of 34 miles an hour, the train was stopped at 591 yards on the average. There were some differences in the gradients, which were not given. M. Gasse's break was only tested on the second day by one series of six runs. The average speed attained was 34 miles an hour, and the average distance run before the train was stopped after the first application of the break was 920 yards. In these experiments the efficacy seemed to lie between Fay's break, which stopped a train (taking averages) running at 36 miles an hour in 507 yards, and Newall's, which stopped a train running at 34 miles an hour in 591 yards. The difficulty of stopping the trains was greater on the last day's trials, owing, probably, to the state of the weather and the rails.

*The term Cinephantic is used to distinguish Mr. H.'s modification from Mr. Gorham's Kaleidoscopic Top, and from other colour tops; and signifies "producing apparent motions," or "producing optical phenomena by motion."

STEAM-SHIP ECONOMY.

TO THE EDITORS OF THE "MECHANICS' MAGAZINE."

Woolwich Dockyard, 19th December, 1859.

GENTLEMEN,—As Mr. Cheverton's letter appears to me to be a repetition of his former inquiry as to the theoretical construction of the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h. p.}} = C$, and a further critique on the fallacious views which he himself entertains as to what he still erroneously supposes to be the application of the formula by myself and others who have adopted this formula, on which subjects I have already responded by letters which appeared in the MECHANICS' MAGAZINE for 18th November (No. 47) and 9th December (No. 50), I have nothing further to say on those subjects in a theoretical point of view, but I am still in hopes that an example of the practical application of the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h. p.}} = C$, as compared with the results consequent on Mr. Cheverton's formula $\frac{V^3 D}{\text{Ind. h. p.}} = C^1$, may lead to a better understanding on the matter of determining, by some rule based on the actual performance of ships, the merits of steam-ships in a dynamic point of view, instead of leaving this important consideration a mere matter of opinionative caprice, not based on any fact of performance with reference to the mutual relation of displacement, speed, power, and coal.

By way of illustration, therefore, let us endeavour to deduce from the known performance of the Banshee what may be expected to be the power that will be required to propel the Great Eastern, with a mean displacement of 18,000 tons as on the late passage from Holyhead to Portsmouth, at the speed of 15 knots per hour.

The Banshee, as is well known, with a displacement of 800 tons, attained the speed of 16 knots per hour, the engines of 350-horse power nominal working up to 1,600 indicated horse-power, which is equivalent to 15 knots with 1,316 indicated horse-power, this performance producing by the formula $\frac{V^3 D}{\text{Ind. h. p.}}$, or $\frac{15^3 \times 800^{\frac{2}{3}}}{1316}$, a co-efficient $C = 221$, which co-efficient applied to the Great Eastern by the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h. p. } (x)} = C$, with a view to determining the indicated horse-power (x) from which 15 knots per hour may be expected, gives $\frac{15^3 \times 18000^{\frac{2}{3}}}{x} = 221$, or $x = 10444$, being the indicated horse-power by which the Great Eastern may be expected to attain the speed of 15 knots per hour, assuming her to be equal to the Banshee in point of dynamic merit.

Now, let us see the result consequent on the adoption of Mr. Cheverton's formula $\frac{V^3 D}{\text{Ind. h. p.}} = C^1$. In this case for Banshee we shall have $\frac{15^3 \times 800}{1316} = C^1 = 2048$, which co-efficient applied to the Great Eastern by Mr. Cheverton's formula $\frac{V^3 D}{\text{Ind. h. p. } (x)} = C^1$, with a view to determining the ind. horse-power (x) from which 15 knots an hour may be expected gives $\frac{15^3 \times 18000}{x} = 2048$, or $x = \frac{15^3 \times 18000}{2048} = 29670$.

Thus it appears that by the ordinary formula which I have adopted as the base of my calculations on steam-ship capability, the Great Eastern (assuming her type of hull and engine efficiency to be equal to that of Banshee) may be expected to attain 15 knots per hour with her engines of 2,600 nominal horse-power working up to 10,444 indicated horse-power, but by Mr. Cheverton's proposed formula it will require 29,670 indicated horse-power to attain the speed of 15 knots per hour. Surely, the Great Eastern has refuted this conclusion.

By the sophistry of some adulators of the Great Eastern, the public have been led to expect a speed of 20 knots and upwards per hour, and the public are disappointed because it is not realised. Others insist that, as compared with other ships, the capabilities of the Great Eastern ought to be judged of by the formula $\frac{V^3 D}{P} = C^1$, and not by the formula $\frac{V^3 D^{\frac{2}{3}}}{P} = C$. The foregoing calculations show what that friendly lift will end in. There never was an enterprise to which the proverb "Save me from my friends" can be applied with greater force than in the present case of the Great Eastern.

I am, Gentlemen, yours very obediently,

CHAS. ATHERTON.

NOTICES.

The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

THE MECHANICS' MAGAZINE AND PATENT OFFICE, 166 Fleet Street, London, will be closed on Monday next in consequence of the Christmas celebration which is to be generally held on that day. Patents in progress will, of course, be duly attended to notwithstanding the closing of the office.

THE APPEAL.

WE have to acknowledge the receipt of a £5-note from some liberal friend—who is content to be known to ourselves and others as "Iota"—for the benefit of the unfortunate lady on whose behalf we lately appealed. For this generous Christmas gift the lady in question desires us to express her grateful thanks to her unknown benefactor.

Our Weekly Gossip.

WE observe with much satisfaction that Mr. W. H. Russell, LL.D., late special correspondent of the *Times*, is about to edit a new periodical entitled the *Army and Navy Gazette, and Journal of the Militia and Volunteer Forces*. We believe the establishment of this paper under Mr. Russell's management will do more than any other single event to make the volunteer force efficient and permanent in this country. His little volume on *Rifle Clubs and Volunteer Corps*, published some few months ago, is by far the most practical book that has appeared on the subject, and shows that the author is one of the few who thoroughly comprehend the risks to which the volunteer movement is exposed, and the means which alone can make it useful and lasting. We may be quite sure that he will not neglect this division of the new journal, and there is good reason to hope that volunteer corps will find in it precisely that guidance and stimulus which would be found indispensable to their continuance.

At the last monthly meeting of the Royal National Life-Boat Institution, a vote of thanks, inscribed on vellum, was unanimously awarded to Mr. C. Clifford, "in acknowledgement of his able and indefatigable exertions in the cause of humanity, in inventing and bringing to a state of perfection an improved plan for safely lowering boats at sea, which is now being brought into general use, and through the instrumentality of which a large number of lives have already been saved from drowning."

A few weeks since we had an opportunity of inspecting, at the works of Messrs. Brown, Lenox, and Co., Millwall, an admirable fire-engine constructed by Mr. William Roberts of that establishment, and fitted with his patent fire-engine pumps. We had the satisfaction of finding, not only that the engine was a very powerful and excellent one, but also that Mr. Roberts had organized a fire-brigade from among the workmen, and had already done good service at more

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than one fire, and that before the established fire-brigades had time to reach the fires. During last week Messrs. Brown, Lenox, and Co's. brigade again did excellent service at the fire which occurred on the premises of Messrs. J. and E. Wright, rope manufacturers, Millwall. The erections in question are about 1,300 feet in length, but the fire was fortunately confined to the large tarring and winding house, adjoining the hemp stores and warehouse. The proprietors state that the fire was completely subdued by the untiring endeavours of Mr. William Roberts and companions of the "True Blue Brigade," who attended with the powerful engine of Messrs. Brown, Lenox, and Co., constructed upon Mr. Roberts's patent principle. "To him especially," say they, "our thanks are due for his praiseworthy effort in obtaining a supply of water from a neighbouring stream, and thus preserving the main body of the premises from entire destruction." The establishment of the True Blue Brigade reflects great credit upon the proprietors of the engine, and upon Mr. Roberts, who conducts the operations of the brigade with so much courage and success. Their example might be followed with immense advantage.

We understand (says the *Athenæum*) that the contributions to the scientific relief fund, organized by the Royal Society, already exceed £3,000, and that the amount has been invested in the public securities in such a manner as to form a separate account from that of the Society's other funded property. With her usual liberality, and desire to make her great wealth useful, Miss Coutts has subscribed £100 to this excellent fund.

The same journal states that a decennial prize of a gold medal and 6,000 francs, commencing from the year 1860, has been founded by a family of the name of Dolfas, at Malhausen, to be awarded to the best essay during the preceding ten years, "on the industrial progress of the Upper Rhine district," or to the discoverer of the most useful invention.

Mr. Chadwick, silk manufacturer, of Mosley-street, Manchester, writes as follows:—

GENTLEMEN,—The continued high price of silk affects so seriously the interest of all engaged in the manufacture, that any improvement in the production is deserving of notice. It is generally known that the imperfect character of the raw silk of China and other countries—its coarseness, unevenness, and foulness—does not arise from defects in the cocoon itself, but solely from the rude machinery employed, and the careless method adopted in reeling it. To remedy this evil, it occurred to me, as a manufacturer, that by importing the cocoons themselves, we could adopt machinery to wind and throw (or partly throw it) direct upon bobbins, and thus not only effect a saving in waste and in the cost of production, but obtain a thread of *any size required*—even and clean. This being an original invention, a patent for the 'process' was taken out on the 14th April, 1853, under the title of 'Improvements in the production of raw and thrown silk.' In this patent another name was associated with mine, for the purpose of having the invention carried into practical operation—my own engagements preventing me giving it the necessary attention. Having more recently, with the aid of my mechanic, Arthur Elliott, and of Mr. Wm. Robertson, mechanician, invented a form of machine which performs the process with perfect accuracy and success, and is so simple in its character that it may be applied either in the silk-producing countries or at home, I beg now to introduce it to the notice of the trade. For this purpose I have had a machine of 80 spindles set up in a central situation in London, where it may be seen at work any day between the hours of eleven and three o'clock, on application to Messrs. Leckie and Co., silk brokers, Winchester House, Old Broad-street. JOHN CHADWICK.

Dr. McCormac, in the following note, revives a suggestion which has often been made but never attended to:—

3 Wellington place, Belfast, 17th Dec. 1859.

In respect of the destruction of the Royal Charter and other vessels on a lee-shore, an available means of safety has struck me very forcibly, as possible in many if not in all these disastrous cases. To be lost on a lee-shore implies that the wind blows from the sea to the shore. Now, what would seem easier than to construct an extempore kite, by means of a couple of sticks, arranged like the letter X, and to stretch upon these sticks a napkin, a silk handkerchief, or a fragment of sail? What boys term a bellyband is then to be attached, a tail also to steady the light machine, and a cord, and it is complete. An hour elapsed from the time the Royal Charter struck till she parted in two; but during that hour, extempore kites might have secured safe and certain communications, one or more, with the shore, and the lives of hundreds, for the interval was but a stone's throw, might have been saved.

HENRY MCCORMACK, M.D.

The following sketch of some of the features of New York appears in a letter from the *Times* correspondent:—"I think that New York stands pre-eminent among the principal commercial cities of the world for maladministration of public affairs. It has an unequalled water front upon two superb rivers, with a tide of only six feet; and yet it is without a dock worthy of the name. Its commerce is carried on over miserable wooden piers, rotting and crumbling away by the weight of the goods put upon them, or its shipping lies exposed in the stream. The island upon which it is situated is narrow, with a crowning ridge in the centre running longitudinally with it. The distance on either side to the river is not much more than from Temple-bar to Charing-cross. One would think that bad sewerage and dirty streets ought to be unknown, and yet it would be difficult to find a large town more marked for either. Water as well as other means of cleanliness abound, yet the odour of the parts of the town occupied by tenement houses is unequalled and overpowering. The town lies on a mass of rock, which comes to the surface almost everywhere, and, oftener than otherwise, has to be removed by blasting to give cellars to the houses. Nothing makes a harder or better pavement than this rock, and yet nearly all the town is paved with rough cobble-stones. But these shortcomings are confined to one side of the account. On the other side the show of municipal taxation does great credit to the wealth of the city. The tax and assessments amount to about 2 per cent. of the gross valuation. Fancy such a measure of taxation upon an estate yielding 5 per cent. per annum."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the proprietors of this Magazine. Other papers are hereby warned not to produce them without acknowledgement:—

STEAM ENGINES, &c., 1166.
BOILERS AND THEIR FURNACES, &c., 1165, 1168, 1171.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c. *None.*
SHIPS AND BOATS, including their fittings, 1142.
CULTIVATION OF THE SOIL, including agricultural and horticultural implements and machines, 1148.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1145.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1147, 1157, 1163, 1172, 1180.
BUILDINGS AND BUILDING MATERIALS, including sewers, drain-pipes, brick and tile machines, &c. *None.*
LIGHTING, HEATING, AND VENTILATING, 1142, 1162, 1170, 1177.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1144, 1169.
METALS, including apparatus for their manufacture, 1150, 1151, 1154, 1176.
CHEMISTRY AND PHOTOGRAPHY, 1156.
ELECTRICAL APPARATUS, 1152.
WARFARE. 1161, 1167, 1173, 1175.
LETTER PRESS PRINTING, &c. *None.*
MISCELLANEOUS, 1141, 1143, 1146, 1149, 1153, 1155, 1159, 1160, 1164, 1174, 1178, 1179, 1181, 1182.

1141. J. DIXON, jun. "Improvements in machinery or apparatus for staining paper." Dated May 6, 1859.

In any convenient position of the ordinary paper-staining machine the inventor places a small box or vessel containing colouring matter, and fixes over it a small hammer or lever having its fulcrum so that one end will be heavier than the other, and by wheels and pinions he causes the said hammer to dip into the colouring box and fall on the paper as it passes through the machine, say at every twelve yards, thus making a mark at the proper place where it can easily be cut into pieces without the trouble of measuring. *Patent abandoned.*

1142. T. JONES. "An improved apparatus and arrangement of flues for heating and ventilating buildings, ships, and other structures, and for causing draughts in chimneys." Dated May 6, 1859.

The patentee uses an apparatus or chamber at the back or sides of the usual fire-places, and an arrangement of flues leading to and from the said apparatus, and also from the lower floors to the fire-places in those above, the air in all cases passing into the chimneys and thus causing proper draught. The apparatus at, say, the back of the usual fire-place consists of two principal parts, made of fire-clay, and forms a chamber or cavity in which air may be heated for distributing and warming apartments; its peculiar construction, (analogous to the syphon), gives a forward motion to the air led to it, thus allowing either cold or heated air to be distributed. *Patent completed.*

1143. W. S. BOOTH. "A new or improved washing machine." Dated May 6, 1859.

This consists of an oblong or other shaped tube or vessel, the bottom of which is concave, and a moveable rubber, the bottom of which is convex, the curves both of the bottom of the tub or vessel and the moveable rubber being struck from the centre or axis upon which the moveable rubber turns, the opposed surfaces of the bottom of the tub or vessel and rubber being provided with ribs or flutes, by which the articles to be washed are rubbed by the motion of the moveable rubber. *Patent completed.*

1144. J. FREARSON. "New or improved fastenings for wearing apparel, and for such other purposes as the same are or may be applicable to." Dated May 6, 1859.

The objects of this invention are, 1, to effect the junction of parts of dress or other articles by a neater and less bulky fastening than the ordinary hook and eye. 2. To prevent or diminish injury to the fastening by pressure, as in ironing or mangling. 3. To effect a more secure fastening when the parts fastened are slack than is effected by the ordinary hook and eye. The nature of the invention is not described apart from the drawings. *Patent completed.*

1145. G. T. BOUSFIELD. "Improvements in apparatus for grinding grain and other substances." (A communication.) Dated May 6, 1859.

This is applicable where two horizontal grinding stones placed one above the other are used, and consists in suspending each stone on apparatus similar to gimbals, so that it is free to incline in any direction. *Patent completed.*

1146. J. COMBE. "An improved plantoforme or apparatus for measuring the hoofs of horses for the purpose of forming their shoes." Dated May 7, 1859.

This consists of two blades of metal with handles fixed together by a central pin, on which they work like forceps or scissors; the blades are curved outwards. On each side of each blade and near to its outer edge, flanges of metal are fixed extending from the central pin a sufficient distance along the blades to clip the hoof beyond the flanges; the blades are graduated on both sides. The flanges are so curved that one is adapted to the outer side of the hoof, and the corresponding one on the other blade to the inner side; those for the outer sides of the hoofs are on the same blade, and those for the inner sides on the other blade; one side of the instrument is adapted for the right foot and the opposite end for the left. A graduated quadrant is fixed to one of the handles, and passes through a slot in the other. A binding screw in the last-mentioned handle acting on the quadrant retains the blades and handles in any position required. *Patent abandoned.*

1147. J. BRAY and J. W. HARRISON. "Improvements in machinery or apparatus for spinning fibrous materials." Dated May 7, 1859.

Instead of the ordinary contact drum and friction pulley for changing the motion of self-acting mules, the inventors place a broken wheel on the cam-shaft, which works into the ordinary packing-off wheel, and gives the necessary change motion without causing the usual noise and shock, thereby effecting a great saving in band straps, wheels, &c., and by being able to give the said wheel a much slower motion than has been done by the ordinary method, they avoid the breaking of the rings on the escape plate. *Patent abandoned.*

1148. A. C. BAMLETT. "Improvements in reaping machines, part of which improvements is applicable to other agricultural implements." Dated May 7, 1859.

The specification of this invention comprises many features in connection with agricultural implements, and is too elaborate to be quoted here at sufficient length for an intelligible abstract. *Patent completed.*

1149. M. HENRY. "Improvements in the manufacture and construction of locks and fastenings." (A communication.) Dated May 7, 1859.

Here locks and fastenings are manufactured for room-doors and other purposes, so that the thickness usual to such articles may be reduced, as also the depth of mortice required for their reception. *Patent completed.*

1150. R. MUSHET. "Improvements in puddling iron and steel." Dated May 7, 1859.

This consists in the use and application in the pud-

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dling steel and iron of ores of tetanium and titaniferous iron ores previously deoxidised for improving the quality of steel or iron obtained by puddling pig iron, or any mixtures of these, into steel or malleable iron, whether the said compounds of or mixtures containing tetanium be used in conjunction with or without oxide of manganese. *Patent completed.*

1151. R. MUSHET. "Improvements in the manufacture of iron." Dated May 7, 1859.

This consists in adding titanium ore, titanic acid, titaniferous iron ores, or deoxidised titaniferous iron ores to pig iron, cast iron, or refined iron, whether melted in a blast furnace or re-melted in a cupold furnace, refining furnace, or other melting furnace, so that titanium may be reduced and alloyed with the pig iron or refined iron. *Patent completed.*

1152. C. FROST. "Improvements in the construction of electric telegraph cables." Dated May 7, 1859.

Here the telegraphic conductor or conductors are first coated with gutta-percha or other insulating material as heretofore, and then surrounded with rings of metal, which are slipped over the conductor or conductors while open, and then closed thereon by suitable nipping instruments. Between the metal rings are introduced rings of cork or other elastic material, so that the metal rings nowhere come immediately in contact the one with the other. To complete the cable a covering of hemp or other fibrous material is put on over the rings either spirally or otherwise. By the use of metal rings the conductor or conductors are effectually protected from damage and at the same time a very flexible cable is obtained. The rings also prevent the covering of hemp or other material from pressing on the conductor or conductors, which are then left entirely free from the exterior covering. *Patent abandoned.*

1153. R. PEARSALL. "Improvements in the manufacture of glass shades." Dated May 7, 1859.

This consists, 1, in connecting the side planks of the moulds to suitable mechanism so that they can be moved to or from one another, and the distances between the planks may thereby be adjusted to the different breadths of shades required. 2. In dispensing with the necessity of re-heating the glass when blowing round or cylindrical shades by blowing such shades in moulds, instead of fashioning them by heating and motion independently of any mould. *Patent completed.*

1154. W. E. GEDGE. "Improvements in the manufacture of steel." (A communication.) Dated May 7, 1859.

Instead of using mineral coal or charcoal, the inventor uses in the process of puddling wood, which wood is used dry but not carbonized. *Patent completed.*

1155. R. D. KAY. "Improvements in the preparation of certain colouring matters. (A communication.) Dated May 7, 1859.

This consists of a mode of of obtaining the colour-matter produced from aniline, or other similar products obtained from coal and other bituminous substances. The inventor combines aniline, &c., with an acid so as to form a salt, the base of which is the aniline or other similar material. He obtains good results from acetic, hydrochloric, or sulphuric acid. *Patent completed.*

1157. J. RAMSBOTTOM. "Certain improvements in machinery for printing fabrics." Dated May 9, 1859.

This consists in certain improved combinations of machinery by whiah a lateral to and fro motion is imparted to the fabric as it enters between the engraved roller and the pressure cylinder of an ordinary printing machine. *Patent completed.*

1158. J. LUIS. "A self-regulating horse machine." (A communication.) Dated May 9, 1859.

This invention is not described apart from the drawings. *Patent completed.*

1159. C. A. H. MARCOUX. "A new impelling mover by the pressure of water." Dated May 9, 1859.

The inventor fills a column with water which he permits to flow alternately into two circular pump boxes, each having a moveable valve, so that one of these boxes may be open while the other is closed. In each of the boxes there is a flat cylinder the piston of which runs down through the bottom of the box and gears into the teeth of a balance wheel which moves with regulated precision, and from this wheel motion is given to any mechanism that may be fitted thereto. On and in each of the boxes a pipe is adjusted which is in direct communication with the reservoir column of water, and as each pump box is opened or closed by the weight of the service acting upon the valves and cylinders, the water contained therein is returned to the reservoir, so that except the loss by evaporation its contents of water is always the same. *Patent abandoned.*

1160. F. V. HADLOW. "An improved stamp for marking linen and other wearing apparel." Dated May 9, 1859.

This consists in substituting in lieu of the metallic type, dies, stamps, or plates, type, dies, or stamps, made of boxwood or other absorbent material, with the letters, words, figures, or other devices thereon engraved or formed in bold relief. The marking inks now in use or any other that may hereafter be found to be suitable for the purpose may be applied to the type, dies, or stamps, by a piece of woollen cloth laid upon a piece of india-rubber, cloth, or other flat non-absorbent substance by saturating the woollen cloth with a small quantity of the marking ink and then pressing the type, dies, or stamps, upon the woollen cloth so saturated. *Patent completed.*

1161. G. G. BUSSY. "An improved contrivance for carrying cartridges, and to facilitate using them." Dated May 9, 1859.

The patentee claims a contrivance for holding cartridges by means of springs encircling them either wholly or in part, and also a method of taking them out of the cases. *Patent completed.*

1162. A. V. NEWTON. "An improved construction of lamp." (A communication.) Dated May 9, 1859.

This consists in applying to lamps a cap, tube, or cone so arranged with respect to the illuminating flame as to form a draught tube provided with one or more conductors so placed within it as effectually to rarify the air within, and supply the illuminating flame with a requisite amount of oxygen without the aid of glass chimney, such draught tube being connected with any suitable deflector vessel or flange which will elevate the lower orifice of the draught tube in the manner and for the purpose above explained. *Patent completed.*

1163. A. MORTON. "Improvements in means or apparatus employed in the weaving of figured fabrics." Dated May 9, 1859.

This relates to jacquard apparatus and adaptations of the loom to act therewith in the production of such goods as damask quilts, and other fabrics, when one shuttle is used, and also for fabrics of the harness work class, such as plaids and shawls, when several shuttles are used in rotation. The details of this invention are too voluminous to be quoted here. *Patent completed.*

1164. E. T. HUGHES. "Improvements in obtaining motive power. (A communication.)' Dated May 9, 1859.

This consists in the use of gas either held in solution in a liquid, or absorbed by a solid body, such as coke or charcoal, and then expelled by heat, and applied as a means of obtaining and giving motive power. The operation of absorption and expulsion being continually repeated, by which the same gas is continually used. The gas intended to be employed instead of steam is ammoniacal gas. *Patent completed.*

1165. T. GREEN, jun. "Improvements in apparatus applicable to steam boilers, to obtain greater security against explosion." Dated May 9, 1859.

This consists in arrangements whereby a valve of a steam whistle (in connection with the piston) will be opened, and the whistle sounded when the supply of water fails. Also in an arrangement of apparatus for conducting the steam from a boiler into the fire-place when the water in the boiler falls below a certain point. *Patent completed.*

1166. N. BARKER and J. A. CARTER. "Improvements in apparatus for lubricating the pistons of steam-engines." Dated May 9, 1859.

According to this invention the oil, or lubricating fluid, is contained in a cup or vessel, which is fixed to the cover of a steam-engine by a hollow stem or tube, in which is applied a plug, which is caused to rotate or reciprocate at each stroke of the engine by being put in connection by suitable gearing with a moving part of the engine. In the plug is formed a recess, which, when it comes opposite the opening into the vessel which contains the oil, &c., becomes full, while the passage into the steam cylinder is closed, and when the plug is moved partly round, so as to come opposite the passage which leads into the steam cylinder, the passage between the plug and the vessel containing the oil, &c., is closed, at which time the contents of the recess in the plug will descend from the plug, and pass into the steam cylinder. *Patent abandoned.*

1167. W. F. NUTHALL. "Improvements in ordnance and fire-arms, and in projectiles to be used therewith." Dated May 10, 1859.

This consists in so rifling arms and adapting projectiles thereto as to reduce the friction to the lowest of which it seems capable, thereby to ensure ease and facility in loading, and yet maintain accuracy in shooting; and this is accomplished, 1, by giving the inner face or bore of the barrel a perfectly smooth surface; and, 2, by adapting the projectile to the arm so that only two fine diameters shall rest upon the bore. *Patent completed.*

1168. R. J. LEES. "Improvements in steam generators or boilers." Dated May 10, 1859.

The inventor employs an outer casing or shell of any required length or diameter, and fixes it either vertically, horizontally, or at an angle within the said casing. He places three or more flues, either parallel or conical, communicating with each other by pipes, the last flue being connected with the chimney and placed close to the shell. If three flues are placed within the shell one or two may be furnished with fire-bars and doors in order to form furnaces, and the other flue or flues may be employed for lengthening the heating surface, the heated air and smoke passing through them to the chimney. In the interior of the furnaces and flues he places any number of tubes for increasing the heating surface, and causing an efficient circulation of the water, the latter passing through the tubes at various heights or distances at the sides, and also through the tops or end of the flues. *Patent abandoned.*

1169. W. WILKINSON and C. WHITLEY. "Improvements in buttons and fastenings for garments, harness, and other similar purposes, and in the method of securing the same." Dated May 10, 1859.

This consists of two or more metallic or other flexible yielding prongs or pins flat or round springing from the centre of the inner part of the button, and capable, after insertion, of being bent for fastening the button to the garment, or other article to which it is attached, either with or without the addition of a washer previous to the prongs or pins being bent. *Patent completed.*

1170. M. DEFRIES. "Improved apparatus for regulating the pressure of gas." Dated May 10, 1859.

The object of this invention is to regulate the pressure of, and in part purify, illuminating gas in its passage from the ordinary gas pipe to the nipple of the burner, or in some cases in its passage from the meter to its exit at the nipple, and thereby economise the article, and lessen the objections to its use. *Patent completed.*

1171. J. NORMAN. "Improvements in furnaces." Dated May 10, 1859.

The patentee claims constructing furnaces with passages for mixing air with the hotter portion of the fire gases, and with arrangements for inducing the subsequent thorough mixture of this mixture with the remainder of the fire gases as described. *Patent completed.*

1172. R. THOMPSON. "Improvements in shuttles." Dated May 10, 1859.

This relates to the construction of shuttles for looms, the object being to lessen or prevent the breakage or separation of the cop. This object is effected by mounting the skewer or spindle upon which the cop is placed, so that such skewer with the cop on it may be capable of yielding longitudinally in the shuttle when the latter is suddenly started or stopped. *Patent completed.*

1173. G. BELL. "Improvements in matches or fusees." Dated May 10, 1859.

This consists in the use of glass, pipe-clay, or other earthenware stems, for holding the igniting composition in order that when applied to lighting a cigar, or otherwise, the stem may not burn through, and allow the ignited composition to fall off. *Patent completed.*

1174. M. HENRY. "Improvements in heating and in supplying air, and in the apparatus employed therein, part of which improvements is also applicable to exhausting fluids." (A communication.) Dated May 10, 1859.

This consists in constructing a furnace or heating apparatus of fire-brick and metal combined; the upper parts of metal and the lower parts of fire-brick. For increasing the quantity of combustible gases, and regulating the action and temperature of the apparatus, steam is admitted at one or more points above the fire-bars. For supplying air steam is injected through a bell-mouth into a contracted part or neck of an air pipe, thereby producing a vacuum, thus causing atmospheric air to rush in through the space round the bell-mouth, and constitute, as it were, an annular current around, or concentric to, a core of steam. *Patent completed.*

1175. W. KELLER. "Improvements in cartridges for guns or small fire-arms." Dated May 10, 1859.

Here the cartridges are made with a percussion cap inserted and fastened to the end of it, so that by the action of placing the cap on the nipple of the gun the powder is liberated. The cartridge is made tapered or cone-shaped when required. *Patent abandoned.*

1176. W. O. BOURNE. "Improvements in the

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means of, and apparatus for, separating metals, ores, and other substances of different specific gravities." Dated May 10, 1859.

This relates to a method of and means for separating metallic ores in which air is substituted for water. The invention is not described apart from the drawings. *Patent completed.*

1177. J. ABSTERDAM. "Improvements in impregnating illuminating gas with hydro-carbon vapour." Dated May 10, 1859.

This consists in impregnating illuminating gas with vapours formed by some hydro-carbon liquid of a high boiling point, such as coal oil, or spirits of turpentine and in the apparatus used for the purpose. *Patent abandoned.*

1178. A. MANBRE. "An improved method of extracting and purifying sugar, called glucose and "Sirop de fecule," from potatoes or fecula, or starch or dextrine, for the purposes and uses of brewers, distillers, vinegar makers, colouring makers, or otherwise." Dated May 11, 1859.

This consists, 1, in the saccharification of a mixture of nine parts of potatoes, or fecula, or starch, or dextrine with one part of flour from rice or maize, together with forty parts of water, the said mixture to be converted into saccharine matter by the reaction of the germinated barley called malt, or by the reaction of sulphuric or any other acid, or by the action of heat. 2. In a purifying process and filtering apparatus of any suitable kind and capacity, capable of being hermetically closed, and furnished with a perforated false bottom, upon which is placed wire gauze, also layers of burnt bones, charcoal, woollen felt, and flannel. The apparatus being charged with the liquid air or steam is introduced over the mass through a cock, when the saccharified liquid is forced through the filter and perforated false bottom and purified, when it is drawn off and received in a copper for evaporation and concentration. *Patent abandoned*

1179. A. MANBRE. "The manufacture of a colouring matter for colouring spirits, beers, vinegar, and other liquids, from rice, maize, carrots, maple, ananas, pompions, chestnuts, mangel-wurtzel, sorgho, turnips, and Jerusalem artichokes." Dated May 10, 1859.

The inventor obtains a colouring matter, and converts into caramel by the action of heat upon the above materials. *Patent abandoned.*

1180. T. P. BENNETT. "Certain improvements in or applicable to carding engines." Dated May 11, 1859.

According to this invention when the carding engine is at work the loose dust, dirt, and flyings that are thrown off by the main cylinder are deposited upon a creeper, and as the creeper passes over a roller they are collected on the surface of a clearing roller which is covered with flannel; or the dirt, &c., may be removed from the clearing roller by a doffing comb. *Patent completed.*

1181. J. LUIS. "An improved burling and napping machine." (A communication.) Dated May 11, 1859.

This invention is not described apart from the drawings. *Patent abandoned.*

1182. H. CLARKE. "Improvements in balancing millstones to the running as well as the standing state." (A communication.) Dated May 11, 1859.

This invention has for its object the balancing of the running stone of millstones to the running as well at to the standing state, which is accomplished by having a number of holes or recesses formed in the said stone with portable boxes, cups, or buckets placed therein for holding lead, shot, or other weighting substance for producing the standing balance, which boxes, or the weights therein, are capable of being raised or lowered in the said holes by screws or other regulating means, and thereby the running balance is effected as required. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Aug. 3, 1859.

1792. T. P. Fay. Improvements in machinery or apparatus for obtaining and applying motive power.

Dated Nov. 22, 1859.

2642. P. M. E. and J. Marchand. Improvements in refining lamp oil made from oleaginous seed.

Dated Nov. 23, 1859.

2650. W. Keates. An improved mode of manufacturing or forming the foundation or body of compound cylinders used for printing or embossing fabrics.

Dated Dec. 2, 1859.

2727. W. Betts. Improvements in the manufacture of capsules, and in the machinery or apparatus employed therein.

2729. T. F. Bradson. Improvements in door springs.

2733. A. V. Newton. Certain improvements in the construction of coiled springs. (A communication.)

Dated Dec. 3, 1859.

2735. T. R. Russell. The application of a certain metal for the movements of watches and other time keepers.

2737. J. W. Wilson. Improvements in the mode of forming and constructing boxes or cases for postal and other purposes.

2739. H. E. Drayson. Improvements in the mode of extinguishing fires in ships, steam boats, vessels of every description, houses, warehouses, stores, or other buildings of whatever kind, and in the machinery connected therewith.

2741. R. Bond and W. Hayhurst. Improved machinery or apparatus to be employed in the manufacture of a certain description of "temples" used in power looms for weaving.

2743. N. Clayton and J. Shuttleworth. Improvements in steam boiler safety valves.

2745. E. A. Curley. Improved mechanical arrangements or contrivances for measuring, registering, and regulating the flow of liquids, and likewise for measuring, registering, and regulating the flow of liquids, and likewise for measuring and regulating the passage of fluids and vapours.

Dated Dec. 5, 1859.

2747. E. Kelly. An improved washstand, part of which is also applicable for other useful purposes.

2749. J. Benn. Improvements in drills.

2751. C. Short, T. B. Smeeton, and W. Bowler. The manufacture of bricks, tiles, drain pipes, or other articles from cinder or refuse slag.

2753. A. Lancaster. Improvements in breech-loading fire-arms, in projectiles, and in apparatus for charging cartridges for breech-loading and other arms.

2755. E. A. L. Negretti and J. W. Zambra. Improvements in stereoscopes.

Dated Dec. 6, 1859.

2757. F. Coignet. Improvements in the manufacture of beton or composition applicable for purposes of covering, building, and construction, and for various uses as artificial stone.

2759. J. Shaw. Improvements in the insulation and laying-down conducting wires for the transmission of telegrams or telegraphic messages.

2761. E. A. Wood. Certain improvements in anchors.

2763. A. Turner. Improvements in the manufacture of elastic fabrics.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Dec.* 20, 1859.)

1792. T. P. Fay. Motive power.
1828. J. H. Johnson. Signal light. (A communication.)
1833. T. and R. Blinkhorn. Removing scale from boilers.
1835. T. Dunn. Regulating liquids; propelling vessels.
1852. G. Capper. Permanent way.
1854. J. J. Speed, jun. Pipes, tubes, &c.
1859. D. Hulett and G. Prudden. Gas.
1863. A. Evaux. Artificial marbles.
1865. J. Philp. Hobby horse.
1871. R. Clegg and R. Fell. Obtaining fresh water.
1876. E. Sloman. Feed water and heating apparatus. (A communication.)
1878. C. Mather. Finishing fabrics.
1881. C. Kisky and W. Jones. Sideboards.
1883. J. Chanter and D. Annan. Furnaces.
1884. E. Stone. Veneers. (A communication.)
1887. H. Batchelor. Motive power engines.
1892. J. Sidebottom. Power looms.
1901. H. J. Hyams. Wet gas meters.
1905. W. T. Henley. Ropes and cables.
1908. J. Fowler, jun., R. Burton, D. Greig, jun., E. E. Allen, and W. Worby. Ploughs, &c.
1918. H. Spratt. Fire-arms.
1936. T. Briggs. Tarpauling.
1953. W. H. Balmain. Glass.
1986. J. Samuel. Railway sleepers.
1992. J. Brine. Producing copies of letters, &c.
2075. F. Heindryckx. Railways.
2114. J. Luis. Hammers. (A communication.)
2115. J. Luis. Railway breaks. (A communication.)
2118 J. Luis. Cooling apparatus. (A communication.)
2119. J. Luis. Lantern signal. (A communication.)
2151. W. E. Newton. Condensing steam. (A communication.)
2194. E. S. Cathels and S. Splatt. Gas meters.
2248. J. M. Rose, R. Carte, and W. Pikesley. Drums.
2320. J. Carrick. Water closets.
2472. R. A. Brooman. Weaving. (A communication.)
2496. R. H. Hess. Gass burners.
2507. E. Juzet. Lubricating apparatus.
2577. J. Madin. Furnaces.
2607. R. Laming. Alkalies.
2635. G. W. Lenox. Ships' blocks.
2672. M. Tildesley. Locks and latches. (A communication.)
2699. J. B. Berger. Facilitating calculations.
2729. T. F. Brabson. Door springs.
2741. R. Bond and W. Hayhurst. Looms.
2743. N. Clayton and J. Shuttleworth. Safety valves.
2751. C. Short, T. B. Smeeton, and W. Bowler. Bricks, tiles, &c.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Dec. 17, 1859.

1461. D. Deas.
1469. A. Jeffery.
1471. R. Harper, R. Stokes, and T. Walker.
1475. P. F. Aerts.
1481. C. L. J. Dierickx.
1495. W. C. Fuller.
1533. G. & T. Wrigley.
1593. J. McIntosh.
1747. E. Hunt and H. D. Pochin.
2181. W. Airey and J. Clayton.

Sealed Dec. 20, 1859.

1479. J. Cox and S. and M. Frankham.
1485. W. Rowan.
1489. E. Gwyn.
1492. J. Meikle.
1498. E. Oliver.
1499. A. Barclay.
1506. J. Apperly and W. Clissold.
1510. A. J. Dessales.
1512. G. C. Grimes.
1516. W. Lister, jun., and T. G. Garrick.
1522. P. Faure and J. Pernod.
1524. T. Howard.
1528. J. Roberts.
1537. T. Leigh.
1542. J. Nash.
1546. T. Wight.
1562. J. A. Wilkinson.
1577. M. Bogg.
1604. C. Hagan.
1617. W. Robinson.
1629. W. H. Harfield.
1631. J. Taylor.
1636. M. Henry.
1653. C. J. Proal.
1678. W. O. Carter.
1681. J. Bernard.
1683. C. Pottinger.
1695. W. H. Harfield.
1712. G. Welch.
1726. W. H. Harfield.
2176. R. Kay.
2214. E. Sonneborn.
2392. C. Seton.
2439. E. Ellis.
2477. J. A. Turner.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

2968. G. Littlewood.
2974. A. V. Newton.
2976. C. F. Vasserot.
2990. F. Levick, jun., and J. James.
2993. Viscount Carlingford.
2995. F. B. Howell.
3002. C. Fay.
3003. J. Brown.
3015. T. White.
3065. W. Irlam.
3084. I. Atkin and M. Miller.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1070. C. Dresser.
1094. A. Krupp.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Dec. 2, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
1157	0 8	1167	0 6	1177	0 3	1187	0 10	1197	2 10	1207	0 9
1158	0 9	1168	0 3	1178	0 5	1188	0 10	1198	0 3	1208	0 10
1159	0 3	1169	0 5	1179	0 3	1189	0 9	1199	0 3	1209	3
1160	0 3	1170	0 5	1180	0 8	1190	0 9	1200	0 10	1210	3
1161	0 3	1171	0 9	1181	0 5	1191	0 7	1201	2 6	1211	3
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1165	0 10	1175	0 3	1185	0 7	1195	0 3	1205	0 4	...	...
1166	0 3	1176	0 7	1186	0 3	1196	0 11	1206	0 3	...	...

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, DECEMBER 30, 1859.

ENGINEERING PROGRESS IN 1859.

THE Institution of Civil Engineers deserves commendation for many reasons, but there is one feature of its operations for which we editors are especially indebted. The Council of the Institution do for us in their annual report what it would be most difficult and burdensome to do for ourselves, viz., bring together notices of the principal engineering works in progress, or which have been completed during the preceding twelve months. This practice has the double advantage, first, of indicating the practical activities of the members and officers of the Institution; and, secondly, of enabling us to repeat to the public a very interesting review of the year's engineering advances.

Commencing at home, the state of the works for the main drainage of the metropolis, under Mr. J. W. Bazalgette, is first described in the present year's report. Attention is then directed to the progress of improving the railway communications of the metropolis, including the Metropolitan Railway and the Victoria Station and Pimlico Railway, both under Mr. Fowler; the Charing Cross Railway, under Mr. Hawkshaw; and the Twickenham and Kingston Branch Railway, under Mr. Errington. Among the lines recently completed in England, are mentioned the Portsmouth and the Manchester and Crewe Railways, both executed under Messrs. Locke and Errington; also branches from the South Staffordshire Railway to Cannock, Norton, Tipton, and Darleston; and, in the Lake District, the Coniston Railway, under Mr. McClean and Mr. F. R. Stileman. The Severn Valley Railway, under Mr. Fowler, and the extension lines to the West of England, in connection with the South Western system, under Mr. Errington, are also alluded to.

Passing to docks and harbours, the extension works of the Grand Surrey Docks, under the joint charge of Mr. Bidder and Mr. Joseph Jennings, are described. An outline is then given of works of this class recently completed under the direction of Mr. Abernethy, including the new docks at Swansea, a dock at Newport, a pier at Silloth, on the Solway Frith, where there is also a dock, and a pier and breakwater at Blyth. In all these cases, hydraulic machinery, constructed by Sir W. Armstrong and Co., was employed for working the coal drops, jetts, dock gates, cranes, &c. At Penarth, near Cardiff, the conversion of the River Ely into a tidal harbour, and the construction of a dock there, with a railway to connect it with the Taff Vale line, has been carried out by Mr. Hawkshaw and Mr. S. Dobson. At the Southampton Docks, extensive works have been completed by Mr. Giles; and at Southport, an iron pier, by Mr. Brunlees. The Norfolk Estuary works have also been progressing under the care of Sir John Rennie and Mr. Fowler, whilst at Eastbourne, water-works have been completed by Messrs. McClean and Stileman.

In Scotland, the inauguration, by Her Majesty the Queen, of the Glasgow Water Works, executed under Mr. J. F. Bateman, was commented upon; and it stated that in the west, the Castle Douglas and Dumfries Railway had been lately opened, whilst the works on the Portpatrick Railway, under Messrs. B. and E. Blyth, were advancing.

The railway system of Ireland has received considerable development. The lines from Longford to Sligo, Athenry to Tuam, Newry to Armagh, and to Warren Point, and Dungannon to Omagh, under Mr. Hemans, as well as those from Athlone to Roscommon, and from thence to Castlereagh and Castlebar, ultimately to be extended to Westport, Ballina, and Boyle, under Mr. Fowler and Mr. Fred. Barry, and from Athlone to Tullamore, Killarney to Tralee, Mallow to Fermoy, under Mr. Le Fanu, with some others of less importance, have been pressed actively forward. At Londonderry a bridge is now being built over the Foyle, under Mr. Hawkshaw, to carry both a railway and a roadway. The graving dock for ocean steamers, at the mouth of the Liffey, near Dublin, under Mr. G. Halpin, and the Cork Water Works, under Sir John Benson, have been completed.

Important lines of submarine electric telegraphs have recently been successfully laid. The cable for the Red Sea line from Suez to Aden, which was manufactured by Messrs. Newall and Co., has been submerged under the superintendence of Mr. Lionel Gisborne, the electrical arrangements having been carried out by Messrs. Siemens, Halske, and Co. This line is now being extended from Aden to Kurrachee. Other lines between Constantinople and the Greek Islands have been laid by Messrs. Newall and Siemens, and but for a defect in a cable lately submerged between Candia and Alexandria, India would probably have been telegraphically connected with the mother country before the end of the present year.

A great step has been gained in the transit to the East, by the opening of the entire Egyptian railway between Alexandria and Suez, including the extensive wrought iron bridge across the Nile at Kafr Zyat. This work was executed by Messrs. R. Stephenson and Co., and Mr. H. Grissell, under the immediate superintendence, in this country, of Mr. G. R. Stephenson; and was fixed by Mr. E. Price, under the direction of Mr. Henry James Rouse, the chief engineer to H. H. Said Pacha.

It appears from a return made to an order of the House of Commons that the Indian Government has guaranteed about forty-one millions sterling for the construction of public works, principally railways, in that empire. The amount of the guarantee is in nearly all cases 5 per cent. On the East Indian Railway, to which Mr. Meadows Rendel is the engineer-in-chief, and Mr. Turnbull the acting-engineer in India, 45 miles have been opened between Burdwan and the river More, and it is thought that in the next year the Ganges will be reached, at Rajmahal. The line between Allahabad and Cawnpore, 126 miles in length, is in full operation, and beyond, as far as Agra, it only awaits the arrival of the materials for the permanent way. Other portions of the line are proceeding with a rapidity hitherto unknown. Of the Great Indian Peninsula Railway, to which Mr. G. Berkley is the engineer-in-chief, and Mr. J. I. Berkley the acting-engineer in India, 195 miles have been opened. A further length of 50 miles is nearly finished, and an additional 50 miles will be completed, by Midsummer next. There are now under contract 785 miles, the entire system embracing lines to the extent of 1,100 miles in length. The Madras Railway, of which Mr. Hawkshaw is the engineer-in-chief, and Mr. J. M. Heppel the chief resident-engineer, has been opened to Goriattam, 96 miles from Madras, the eastern terminus. By the end of the year it is hoped it will be completed to Salem, a further distance of 110 miles, or about half way to Beypoor, the western terminus. Probably by the end of 1861, the whole of the main (south-west) line, 405 miles in length, will be opened, when there will be a through communication by railway across the Peninsula, between the Coromandel and the Malabar coasts. In Scinde and the north-west Provinces of India, the railway between Kurrachee and Kotree, the steam service upon the river Indus, and the Punjaub system of railways connecting Mooltan with Lahore, Umritsir, and Delhi, are making rapid progress under the direction of Mr. T. A. Yarrow, and the immediate superintendence of Mr. John Brunton, in Scinde, and Mr. W. Brunton, in the Punjaub. Measures are being taken for prosecuting the works on the Eastern Bengal Railway, in the hands of the late Mr. Brunel until his decease, but now transferred to Mr. Hawkshaw; on the Great Southern of India, under Mr. G. B. Bruce; and on the Calcutta and South Eastern, under Mr. J. A. Longridge.

During the present year the first steps have been taken in an enterprise which promises to rival even the Grand Trunk Railway in magnitude and importance; this is the establishment of the Madras Irrigation and Canal Company, for the construction of canals of irrigation and transit throughout the Madras Presidency, and the adjoining states, and ultimately in other parts of India. The engineer-in-chief of this undertaking is Colonel J. T. Smith, M.E. An extensive iron pier is now being erected at Madras by Mr. F. Johnson. A survey of the Island of Mauritius, made at the instance of the colonial government, by Mr. J. A. Longridge, during the last winter shows the great local benefits which the railway system would confer on that colony.

Turning to the Continent of Europe, the railway system in Spain first claims attention. During the present year the great line from Madrid to Alicante, with a branch to Valencia, has been opened throughout. Other branches of this line are in progress to Toledo, and to Ciudad Rodrigo. There are also in course of construction two grand lines from Madrid towards France; first, the Northern of Spain, which proceeds by the Escorial, Valladolid, Burgos, Miranda and Vittoria, to Alsasua; second, the North Eastern route, by Guadalajara, Zaragoza, Tudela, Tafalla, and Pamplona to Alsasua, where it joins the Northern of Spain; and from whence a common line is to traverse the Cantabrian Pyrenees to Villafranca, and onward by Tolosa, St. Sebastian, and Passages to Yrun, on the frontier of France, only twenty miles from where the French lines at present terminate. Great exertions are also making on the line between Barcelona and Zaragoza. The Biscayan railway, from the port of Bilbao to Miranda, on the Ebro, and thence along the right branch of the river to near Tudela, is in course of construction by Messrs. Brassey, Paxton, and Wythes, under Mr. Vignoles. The Spanish Government appear to be anxious to push the extension of railways throughout the Peninsula, offering subventions as an inducement; but the interference of the Government in all the details of construction is a great drawback to the introduction of English capital, and to the satisfactory progress of the works.

In Italy, Piedmont, Austria, Prussia, and Holland, but little seems to have been done; while in Sweden and Norway the railways are slowly but steadily extending.

At Copenhagen Water and Gas Works have been recently constructed under the superintendence of Mr. Simpson; and a large tract of land has been recovered from the harbour, and a dry dock constructed by Mr. A. Giles. The project of Mr. Murray to extend the harbour southward, by cutting a channel through Kallebod Strand, between the islands of

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Amager and Zealand, has recently received the sanction of the Danish legislature.

The English system of waterworks appears to be making considerable progress abroad. During the past year works for the supply of Altona, from the Elbe, at a distance of eight miles, have been constructed by Mr. Hawksley, who has also commenced other works, in conjunction with local engineers, for the supply of the cities of Stockholm, in Sweden, and Bridgetown in Barbadoes.

In Russia, the Riga and Dunaberg railway is progressing under Mr. Hawkshaw, and is expected to be completed early in 1861.

In the Brazils, four commercial cities on the sea-board have been selected as the starting points of railways, to proceed into the interior, viz.: Recife or Pernambuco, Bahia, Rio de Janeiro, and Santos. The first section of the Don edro Segundo Railway, at Rio de Janeiro, has been constructed by Mr. E. Price. The works on the Pernambuco Railway are being vigorously prosecuted under Mr. Gregory and Mr. Peniston; a section, nineteen miles in length, was opened in February, 1858; and a second section will, it is expected, be completed in the summer of the next year. The Bahia Railway, which is eighty miles in length, is under the direction of Mr. Vignoles, and the immediate superintendence of Mr. Hutton Vignoles, the contract for the works having been taken by Mr. John Watson. The first section will probably be finished by Midsummer, 1860, and the entire line in 1863. Both the Pernambuco and the Bahia Railways are designed to terminate, ultimately, at the River San Francisco, about 300 miles from the mouth, at or near the point where navigation ceases. The surveys and explorations for the railway from Santos, better known as the San Paulo line, have been made, under the direction of Mr. Brunlees, by Mr. Fox. Several hundred miles of macadamized roads have been laid out by Mr. Hutton Vignoles through the province of Bahia, partly in connection with the railway. These are fast approaching to completion under Mr. Watson as contractor. The works of the Mangarratiba Serra Road have been carried out by Mr. E. B. Webb. The hydraulic works in front of the city of Rio de Janeiro are progressing under Mr. C. Neate; and Mr. Law has undertaken the construction of the docks there. Gas works have been established at Rio de Janeiro and at Pernambuco, and others are in contemplation for Bahia. Mr. C. B. Lane, the Engineer-in-Chief to the Home Government at Rio, and Mr. W. Martineau is the Government Engineer at Pernambuco.

The above review cannot be read by any Englishman without a glow of national pride. In every quarter, in almost every land, of the globe English heads, English hearts, and English hands are at work, making even the waste places of the earth glad. The Institution of Civil Engineers in particular must be proud of such a survey, for every engineer mentioned in it is either an officer, or a member, or an associate of that able and active body.

IT is understood that the arrangements for the execution of the new coinage of mixed metal have made some progress, and Mr. Leonard Wyon, medallist to the Mint, has been recently favoured with several audiences of the Queen for the purpose of obtaining a correct profile of Her Majesty for the formation of the *obverse* of the three denominations of coin. It may be trusted that little time will be expended in completing the plans for the contemplated improvement, and that early in the new year the new money will be issued, to the great convenience of Her Majesty's lieges, whose pockets are now "bowed down with weight"—of copper.

ON HEAT.

EXPERIMENTS AND OBSERVATIONS TENDING TO PROVE THAT THE HEAT WHICH DR. BLACK DISCOVERED TO BE ABSORBED DURING THE LIQUEFACTION OF ICE, AND WHICH HE CALLED LATENT HEAT, IS NEVER GIVEN OUT AGAIN ON THE FREEZING OF WATER, WITH REMARKS ON A PECULIAR PROPERTY WHICH SEEMS TO BE DEVELOPED IN WATER AND MANY OTHER FORMS OF MATTER ON CHANGE OF STATE.

By HORATIO PRATER, ESQ.

(*Concluded from p.* 406.)

LET me now examine some of the *most recent* observations on this subject, contained in the *Phil. Mag.* for March, 1860.

(1.) "Water may be cooled to 22° without freezing, *and apparently kept so any length of time* unless touched by a piece of ice or other solid, when the water freezes and becomes warmer." This is ascribed to "the existence of cohesion among the particles enabling the water to withstand a change of temperature, which, without the cohesion, ought to have caused a change of state."

(2.) "Donny has heated water to 270° (at common atmospheric pressure) without its passing into steam; into which, however, it does when a particle of air or vapour touches it, when it explodes, its temperature falling." See also Péclet (Tom. II., page 153, 1860) where water was heated without boiling to 246° by covering it with a layer of oil previous to boiling to expel the air.

(3). "The growth of crystals seems to depend on this attraction of cohesion, as this matter is attached to such crystals, and does not deposit so easily elsewhere."

I have selected the above three paragraphs for comment, because they seem to contain the last opinions of one of the most laborious experimentalists of the age, and because it will be seen they differ widely from the opinions I have already in this essay ventured to propose on the same point.

Now that cohesion exists, *or may be developed* in water is clear from M. Boutigny's experiments, *among others*, who found that when *it rains* into a red hot crucible, the water still passes into a spheroidal state. I say this experiment proves that a wonderful cohesive force may *be developed* in water, but as cohesion in the above extract (No. 1) is said merely to "*exist*," without giving the reader any opinion *as to whether this cohesion may not be increased or diminished in certain circumstances* —in short, whether this cohesion is not, like irritability, a VARIABLE quality, I think it may be regarded as no explanation whatever of the fact that water may be cooled to 22° and (as I before stated) even to 5° without freezing.

If the above theory of "cohesion existing" had any real meaning the auther should have expressly stated that as touching water at 22° with a solid causes freezing, it follows that the *mere slightest touching can diminish cohesion*. But can such be a physical property, or is it not certainly *far* more like a physiological property? Undoubtedly it is, for to "diminish cohesion" in what is called inanimate matter, you must not merely TOUCH SLIGHTLY, and observe, too—*at one small point*—but, as we all know (at least in the case of solids), use great force and touch *all* parts, or the cohesion of the solid will not be overcome and a powder formed. The author in question was also bound to try and explain *how* such mere touching could diminish cohesion, and yet this cohesion be (as he never even ventured to doubt) a mere *physical* property. And mark, by "diminishing cohesion" in the above case, we actually form a *greater quantity of cohesion*—for we form ice from water—a body hard from a body soft. When a muscle is even *barely* touched, there is a sudden increase of cohesion and increased hardness from contraction, produced by this *irritation* of touching.

In a former essay, while commenting on the fact that solid carbonic acid may be held in the hand without producing a painful sensation of cold, until *contact* is established by mixing it with ether (Boutigny), I have noticed the strong analogy that exists between great degrees of heat and great degrees of cold. In the present occasion the analogy also holds, for as the cohesion of water in the spheroidal state is increased by the heat, so as certainly in the case of *ice* it is by the cold. In every case of freezing, then, we have proof *that cohesion is a variable quality*, and that a *vast increase* of this force is actually *generated* either by excessive heat or excessive cold.

But the most remarkable point in the case of water (and a very few other bodies) is, that *expansion* should take place, *and at the same time cohesion be increased* so greatly in the ice formed. This fact gives rise to another equally singular, viz., that (as Forbes and Tyndall have lately found) the cohesion of ice, contrary to what happens with substances in general, is actually diminished by pressure, and consequently that it is by this means changed again to water.

The above reasoning applies equally to (No. 2), where we find the mere touching water at 270° causes in this case a reaction, in the form of actual explosion. Yet that these effects, so different—in the first case ice, and now vapour—are produced by the *same* physiological cause I see no reason to doubt, for they resemble each other *in this main feature*, viz., a *great change of state* has been produced by the *irritation* applied. It was *physically* impossible that water above boiling could be turned to ice as it is when cooled to 22°; it shows, then, but in *another way* (viz., by explosion), that a NEW faculty (*nisus*) has been developed in it. In both the above cases matter is put into a FORCED state, just as it is in living bodies. No doubt the degree of irritability produced is *far* less, or perhaps *somewhat* different, but in its main feature it is the same.*

In (No. 3) the growth of crystals is ascribed to this cohesion again, and probably here with truth; though some opinion on the nature of this force, that makes it prefer contact with its own particles to those of other matter, might again have been expected.

I have already in a note alluded to a very curious property in regard to the crystallisation of carbonate and sulphate of soda, when in what may be called *super*-saturated solutions, by which means they are brought to a sort of tension (so to call it), a state in which—like water at 22° (water super-saturated with cold)—an extra portion of irritability seems to be developed in them, or to *say the least*, their own inherent irritability seems put in the *very rare circumstances* in which *it can manifest itself* to the chemical philosopher. Probably the case of fused tin already given, and also of "phosphorous and sulphur which often remain liquid at the common temperature of the air, but touched by a rod *give out heat* and become solid," says Thomson (p. 174), should be added to the above *peculiar states of tension* of matter. Thomson himself has grouped them together, but it is singular that while he has given us such a detailed examination of the cause of the heat in water cooled to 22°, and of the solutions of carbonate and sulphate of soda, he has totally passed over any attempt to explain the cause of this evolution of heat in melted sulphur and phosphorous, as he formerly did that of fused tin, and wisely, for the mere *mechanical* theory of latent heat seems wholly inadequate to explain this surely *instantaneous generation* of heat.

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* In Péclet's experiments, above given, if the temperature is raised *above* 246°, a great quantity of explosive vapour is generated. As the water is put in what may be called a very unnatural state (all its air being first removed and a layer of oil preventing *its contact* with fresh air) no wonder that an extraordinary power of resistance to change of state is developed, and that this *nisus* increases its tendency so much to expand that it becomes explosive.

In Regnault's "Cours," Tom 2, p. 368, the atoms of glass seem put into this forced state by letting melted glass fall into cold water, by which means "the surface is made to solidify while the interior is at a high temperature." When this surface, "even in a minute point," is broken, the interior explodes and flies off into dust. The curious part in this experiment is, that the internal atoms *retain* this explosive power, and do not gradually lose it by cooling.

Chloride of azote and all other explosive compounds may be grouped under the same head of matter placed in a FORCED state.

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Applying the above reasoning to the case where the *lowest* forms of life *seem* (to say the *least*, after the late discussions in the *Comptes Rendus* for the present year) produced in fermentation and putrefaction, it would appear that the *nisus* developed in these cases more ostensibly than in the others noticed in this essay, arises, however, like that of water, &c., &c., from matter being forced to change its state. In fermentation and putrefaction especially, the atoms are about to be robbed of their accustomed state of cohesion by the, *at last*, conquering force of the chemical affinity of the oxygen of the air. The *nisus* to resist is developed—and is it too much to suppose, after the great number of able writers on the side of spontaneous generation, that the lowest forms of *integral* life *therefore* result, and not merely as in the cases of water, &c., &c., a *half* developed state of irritability?

I conceive the *generation* of heat in certain and peculiar circumstances as proved: but it seems a law of Nature that what is susceptible of generation is also as a necessary consequence susceptible of annihilation, or as applied to organized matter—of death. This reflection renders it probable that heat may *sometimes* be annihilated; and that it should be more often annihilated where it enters water or ice than in other cases is rendered still further probable by the *natural antagonism between fire and water*, so that we throw water on fire almost by instinct when we wish to extinguish it. Nevertheless, that the 140° that enter in to liquify it are annihilated (or even converted to other force) I still only venture to suggest as most highly probable; and shall pursue these inquiries at length, as connected with the subject of specific heat, before I venture to say we have *proof* on the subject—the object of this essay being to *prove* they cannot be all given out again.

At present I shall merely state the obvious fact that if water were heated or cooled as rapidly as mercury, certainly the vast majority of fish would necessarily perish. There *seems*, then, to be a *final* cause for the great "capacity" of water for heat; as also by its expansion (and consequent increase of levity by freezing), since by this rising of water about to freeze to the surface, the under portions are prevented from freezing in a great measure, I believe, by the fact already mentioned in reference to water cooled to 22°, viz., that *contact with air* hastens congelation; and, secondly, that when ice is formed at the surface, Tyndall's experiments with Harrison's freezing apparatus show that it took, in the month of April, nine hours' constant action to cool ice from 32° to −3° (or 35°). And that on stopping the apparatus, the heat rose to 27° in about *an hour and a half only* (*Phil. Mag.* Nov., 1858). In this case the heat of the air was no doubt at temperate; but we may still infer that when the external air is at 22°, or less, it will take a *very long time* to cool the ice of lakes or rivers to that point, and consequently that a superficial layer of ice may in one sense, to say the least, actually prevent the freezing of the water underneath it by preventing not only the motion above alluded to of material particles in the air, but also from its acting as a sort of non-conductor of cold when the temperature of the air falls below 32°.

As the great antagonist power of heat, I have had occasion in two or three places to show that *cohesion* has, in reference to its capability of *variation*, more of the nature of *life* than is commonly supposed. I here add a few more points in favour of this view:—

1st. The solids in living bodies are deposited in a far greater state of cohesion than they are in inanimate matter; witness the state of powder without cohesion, in which solids are precipitated from solutions compared with the tenacity of muscle, tendon, and of *wood*. The cohesive force *unites the atoms of organic matter together*; otherwise, like the precipitates just noticed, they would be incoherent masses.

2nd. That cohesion seems to act *spontaneously* in living bodies; while its action in inanimate matter seems, generally speaking, to require the EXISTENCE of pressure, or of cold, or of both these agents combined, to enable it to act. So that in living bodies it chiefly merits the name of an *active* power. Hence the probability of its being some modification of the vital power.

3rd. That when heat is withdrawn, its very great force in producing ice shows it to exist as a very *active* agent in water; particularly at the time of freezing—a fact which, to say the least, makes water a fluid *sui generis*.

P.S.—In different parts of this essay, I have considered it possible that heat may be separated into "pure repulsive force," and into that which can cause the sensation of pain in us. I now think that these properties are one and the same, and that pain arises from the repulsive power tending to *separate* the tissues *forcibly*. As the temperature of ice is not raised during its formation, it seems, however, probable that the repulsive power of heat may be sometimes separated from its power to raise temperature. We find these powers separate in Nature: for by applying *mechanical* power *very gradually* we may scarcely raise temperature at all, and yet obtain the result of repulsive power, viz., greatly *increased bulk*, as in the case of ice.

Sometimes, however, mechanical force may be employed to *compress atoms*. It should therefore perhaps be called a passive force, as it may produce opposite effects, the will being the *active force that directs*.

APPENDIX.

On reviewing my essay, I find two or three points that seem to merit further notice.

1st. Not wishing to increase scientific heresy, so to call it, further than the interests of truth appeared to require, I adopted, without much reflection, 140° or *thereabouts* as the "heat of fluidity" of water. I will now venture to suggest whether this is not far too high, since we know that *when we heat water to a point far below this we can't bear the hand in it*; but also more especially since by the experiments given at the beginning of this essay, we find that *water* at 32° still makes water at 172° fall to 70°, while snow made it fall to 36°, whether we ought not to deduct this 36° from 70°, and put down the difference, viz., 34°, as *about* the latent heat, or rather heat of fluidity of water? These 34° seem the real quantity of heat converted or lost in consequence of snow or ice (at 32°) being used instead of water at 32°, *which seems the main question*; though of course I admit that even in my experiments 136° (and in Dr. Black's 140°) disappeared when snow or ice was converted into water by being mixed with water at 172° "*without raising the temperature of* (as Thomson says, p. 163) *the snow or ice.*" (His grand argument for making 140° the heat of fluidity.)

When by mixing water at 32° and at 172° the whole in my experiments became 70°, it may be said in one sense that 102° have disappeared most certainly, although as in reality they have only been employed in raising the temperature of part of the water from 32° to 70°, they are sensible to the thermometer, and cannot be called "latent." But still they surely should be deducted from the 136° that disappeared when mixed with *snow* and water at 172, and 102° from 137° will leave us 34° (as stated above), as surely a nearer APPROXIMATION (for by the text it will be seen others differ from Dr. Black's No. of 140°,) to the heat of fluidity of water, than the said 140°.

Again, it is highly improbable that ice can ever get even *in the slowest way* a heat of 140° to melt it, seeing that thawing begins a little above 32°. Even supposing the air at 45°, what a long time it would take to accumulate these 140°.

By reference to the experiments at the beginning, it will also be seen that when I doubled the proportion of snow, I could not cool the water below 36°, nor when I doubled that of water at 32° did I get the temperature lower than 70°, the point to which the mixture of 1 part at 32° and 1 at 172° ULTIMATELY fell. This seems to show you cannot always ultimately augment intensity of cold, in water at least, merely by increasing the quantity of cold by means of adding fresh portions of colder water. No doubt when the proportion at 32° is doubled, the thermometer will fall to 70° *in far less time*. I have made further experiments on this point, but they are still not sufficiently extended to find an error in the above inference, which still I confess seems very improbable.

Since the essay was written, I have also exposed water in a tightly corked bottle, and also in one loosely corked (in each case very little air being in contact with the water), to the freezing temperature. The former did not freeze, the latter did. This shows that the contact of air, *abstractedly considered*, does not seem to promote freezing, until this air is (as in the bottle loosely corked) enabled to move, though even in a *limited degree*. This confirms Thomson's and Regnault's statements (see text) that air causes water cooled to 22° to freeze, by its producing MOTION in it, like any other solid, for these, says Thomson, act in the same way.

According to Thomson's tables (*On Heat* pp. 26-27) Rose's fusible metal and phosphorous expand very *suddenly* at their melting points, and as Thomson says, "quite independent of the temperature added," because far beyond such small increased temperature. The *nisus* then of these matters to resist, just as they are having change of state forced upon them by heat, seems no less clear, from the, so to call it, spontaneous dilitation than from the equally spontaneous dilatation of ice at its formation, certainly not from heat, since, in this case, it is being subtracted. Yet Thomson never speaks but of the "*spontaneous* evaporation" of water.

I have stated in the text that I doubted if more than the *mere* surface of water could ever be frozen if 140° had to be given out. In consequence of the air having been lately at Paris at from 16° to 18°, I have been able by the following experiments to *prove*, I think, the truth of this supposition, since on two occasions—once in a small tin vessel, and once in a common tumbler—I found *complete* freezing of the surface to take place in 17 minutes, and on breaking the surface of the ice and pouring out the water, I found a solid crust of ice all round the sides and also at the bottom, so that *this water, which certainly in another hour would have been all frozen*, WAS COMPLETELY SURROUNDED BY ICE. Here, then, is an *experimentum crucis*, for how could it give out these 140° and not melt the ice?

2. Though the *freezing was so very quick*, I could not detect any rise of the thermometer on holding it *over* this water while freezing. And a thermometer kept in the water during freezing did not sink certainly below 30° during that process, though the air was at 17°, verifying Thomson's statement. The atoms during freezing being in want of a heat up to 30° or 32°, retain it in opposition to the air by the *nisus* developed, and employ *it* (the heat of fluidity) in the expansion which takes place. So strong and wonderful is this power that I found that even by putting water in a mixture of snow and salt I could not make it sink to the temperature of the air, though oil so placed very soon fell to 20°, *for as this did not freeze* there was no *nisus* produced to keep up its heat (otherwise it would probably have kept far above the temperature of the air, as water does).

In these experiments I found water was frozen into a firm solid in glass vials, and that the *lateral* seems certainly as great, *if not greater*, than the upward pressure, as on one occasion the vial was cracked on all sides, though I had merely pressed a piece of paper round its mouth (WITHOUT TYING IT), which, too, was full ¼ of an inch from the surface of the water; and on another occasion a narrow-mouthed cup covered LIGHTLY with a tin cap was cracked. The necessity to freeze suddenly being so strong, did these act as irritants, and *increase* the lateral expansion? At all events, the motion of freezing is very different from the motion of *fluids* when they are pressed on, for they would soon have forced the paper or cap off, *where the pressure was least*.

4. Although, as already stated, water may be

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cooled to 22° or below by perfect exclusion from air, yet I found it always *ultimately* froze into a firm solid when the air was at 18°. A mechanical cause, then, here clearly at least *assists* this possibility of remaining fluid at 22°, and it is the fact that when the atoms of air are confined, they of course cannot move away when they have robbed the water of part of its heat, and thus give place to colder ones. Thus, when bottles of water are tightly corked as this cannot cool so *quickly* as when exposed to air, the atoms of water are not *hurried* (so to speak) to a new and forced arrangement. Hence the water remains fluid even below 22°. It can resist slow, but not rapid, abstraction of heat.

That, however, all this is a mere *question of time*, was shown by my experiments when the air was only at 24°. In this case water remained fluid two hours before the surface was FULLY frozen, while we see above it froze in 17 minutes when the air was at 16° and 18°.

SUFFIELD'S ENGINE-ROOM TELEGRAPHS.

IT gives us much pleasure when we are able to lay before our readers descriptions of machinery or processes of manufacture which are actually in successful and daily operation, as distinguished from those inventions with which we have frequently to do, and which are occasionally little more than crude ideas, found to involve considerable labour in working them out before arriving at results which fully answer the purpose intended. It not unusually happens that inventions in the course of being rendered really workable are so far modified from what was at first conceived that little resemblance remains in them to the things they were expected to be like, inventors frequently abandoning their original ideas altogether, new lights breaking in upon them as they proceed. It is peculiarly satisfactory when we can witness any arrangement of mechanism which has passed through these uncertain stages of its existance, and become sufficiently perfect to warrant us in presuming that it is subject to no change which can either increase its efficiency or even diminish its cost, all being done that is necessary in both these directions.

The invention which we now purpose to describe, although in its perfected form exceedingly simple, is just one of those which has passed—to employ a piece of common but indifferent imagery—through a most fiery ordeal, but from which it has escaped thoroughly unscathed. It is one, moreover, which presents this peculiarity, namely, that if it had not been rendered perfect it would in all probability be worse than useless to attempt its adoption, as it might bring about the very calamity the occurrence of which it is designed to prevent. From the first time steam-vessels were started, their comparatively rapid movements when compared with sailing-vessels has rendered it hazardous, both to themselves and other craft, to work them in crowded or confined places when their steam-power was employed, and perhaps even more so when running with full steam in the open sea, in the dark, or in hazy weather. To suddenly stop or move, especially to change the direction of motion of a heavy mass like a large vessel under full steam, is no easy matter even under the most favourable circumstances, but when this is required to be done in rough and boisterous weather, with steam blowing off at the time, or, in the case of war-vessels, when evolutions are necessary during an action amidst the din and roar of cannon, sudden movements or stoppages are rendered absolute impossibilities unless means are provided for communicating instantly and with certainty from the person in charge of the vessel to those in charge of the engines. The old and still not uncommon plan of stationing men at certain intervals along the upper deck, and in large vessels on several of the lower decks, to pass the directions of the commander to the engineer, is one not only most expensive, as it involves several hands being employed, but one upon which no dependence can be placed, directions being frequently misunderstood, besides taking several seconds or even minutes in being transmitted. Most captains of vessels in the merchant service have, during the last few years, been fully alive to the importance of the adoption of some more perfect means of communication, but it was not until several vessels had been totally lost and many very seriously damaged from want of these means that their owners acknowledged the importance of what had been devised to further the safety of their property.

The invention and general arrangement of marine engine-room telegraphs of which we here give illustrations, have been perfected by Mr. T. Suffield, of Bermondsey-wall, after several years of practical experience with them on board British and foreign merchant steamers and foreign government vessels, and, as we have said, very recently on board the vessels of H. M. Navy. We are much pleased to learn that the Lords Commissioners of the Admiralty have just given Mr. Suffield extensive orders to fit several line-of-battle ships and frigates with these valuable and useful instruments. In a recent number we laid before our readers the result of a series of experiments with the above and other telegraphs carried out at Sheerness under the able direction of Capt. Halsted, and noted the superiority which the telegraph under notice maintained. On board the Great Eastern, also, Mr. Scott Russell and Captain Harrison fully acknowledged the great services these instruments had rendered while steaming down the river, and the reliance they placed in their accuracy. This favourable opinion was completely shared by the engineers working the paddle and screw engines.

In proof of the very rapid action of these instruments we may relate the following circumstance which occurred on board the Great Eastern on her passage round to Holyhead. One of the sails getting loose, and the wind dashing it in contact with the lever of one of the deck dials, caused the indicator to fly round from "full speed" (ahead) to "full speed" (astern). Such a sudden signal to the engineers of the screw engines very naturally much surprised them, but in obedience to the signal, the engines were almost momentarily reversed, thus proving what could be done in a time of need, the engineers below imagining nothing short of some vessel having come across the Great Eastern's bows or other like catastrophe. Captain Harrison instantly noticed the reduction in the speed of the vessel, sprung to the dial, and gave a counter-order, which was carried out without a word having been spoken, and in the same time as before by those in charge of the screw engines. On the circumstance being communicated below to Mr. Langdon and Mr. Beckwith, who were in charge of the screw engines, and representing Messrs. Boulton and Watt, it caused some degree of pleasure to learn there had been no danger, but proved most completely the possibility of rapidly and with certainty passing the word without any chance of being misunderstood.

We here endeavour to show the various fittings and the mode of working the telegraphs when fitted to merchant steamers, as also to line-of-battle ships and frigates. The deck dials for use of the commander consist of brass domes *A A*, Fig. 1 and 2, fitted with internal lamps and reflectors, and a divisional dial *B B*, Figs. 5, 6, and 7 (the latter on an enlarged scale), glazed and lettered in glass for illuminating by night. To prevent the whole surface of the illuminated dial affecting the sight of the commander when taken off it, a simple and efficient arrangement is made, termed a night-shade, which by the working of the lever opens to the sight that division only which has upon it the signal which is to be communicated. These domes *A A* are fitted in the most convenient place for instant communication by the commander at each side of the ship, as we have said, either on the bridge or in the hammock nettings near the gangway, or sometimes on the poop, connections being made from them by gearing very neatly and substantially arranged, as shown at *C C*, Fig. 1, consisting of bevil wheels fitted in cast-iron brackets fixed in convenient positions against the side of the ship or on the side or underneath the deck beams; the shafting from each side of the ship meeting at or near the centre of the vessel at *D*. From this point the shaft either dips vertically or runs along horizontally (fore and aft) as the case may be, to the engine room through the deck beams, or in the most suitable manner, and terminates at the back of the engine-room dial *E*, Fig. 4, when the communication is complete. In order to ensure that no strain can be put upon the shafting and gearing when the ship is taking in her cargo, or working in a sea-way, Mr. Suffield has arranged a very simple piece of mechanism termed an "expansion joint," *F F F*, Fig. 1, which admits the whole of the gearing working with a degree of accuracy and freedom otherwise unapproachable.

One of the most important parts of the arrangement consists in the engine-room dial and gong—Figs. 3 and 4—which are remarkable for their simplicity, certainty of action, and non-liability of derangement. They consist of a powerful gong, worked in conjunction with a figured dial (Fig. 3), protected and secured by a brass glazed frame under lock and key, in charge of the chief-engineer. This dial is fixed immediately before the engineer, on the opposite side to the starting gear, in a convenient and open position. The commander, communicating from the deck dials, causes the gong to sound at every move of the index-hand of the engine-room dial, which latter at once shows to the engineers the order given. This index cannot be passed from one word to another without striking the gong and calling the immediate attention of those below. Another important arrangement consists in fitting "attention" bells both in the engine-room at each deck-dial (worked by foot or otherwise), by which a communication can be kept up between the commander and engineer during stoppages or other causes previous to giving orders by the engine-room telegraph which are imperative, the telegraph never being touched except it be intended that the order given should forthwith be carried out. This completes the arrangement of communication.

The distance from the bridge to the gangway is, however, in some vessels we have seen as much as 80 feet, and unless dial plates are also fitted in the former position, men must necessarily be employed to pass the word from the commander (if on the bridge) to the man near the gangway, by whom it would be passed backwards to the engineer by means of the telegraphs.

We are informed that Mr. Suffield has been making a number of double-acting telegraphs for a foreign government; also some for an eminent engineering firm. We trust the advance he is now making will reward him for the indefatigable attention he has given to perfect the instruments having practically experimented with them for some years at a considerable outlay, with the determination to produce an efficient and durable instrument, and one which should answer every requirement for the prevention of derangement. From what we have seen of the invention we feel satisfied that he has succeeded in producing all that can be desired, and most heartily wish him success in getting the instruments into general use. We hope soon to be able to lay before our readers a simple and efficient steering apparatus to be worked in conjunction with these telegraphs, and which is now undergoing completion by the same manufacturer.

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SUFFIELD'S ENGINE-ROOM TELEGRAPHS.

FIG. 5.

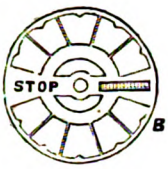


FIG. 1.

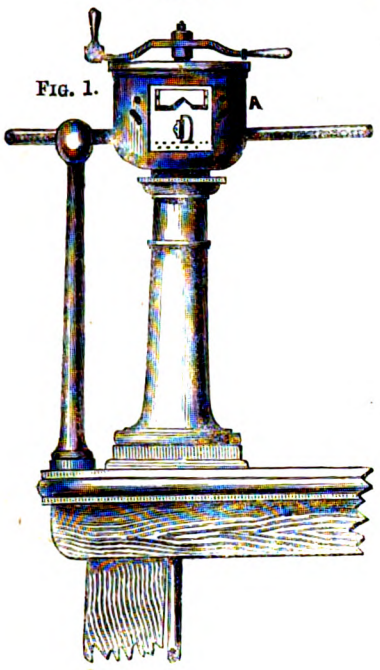
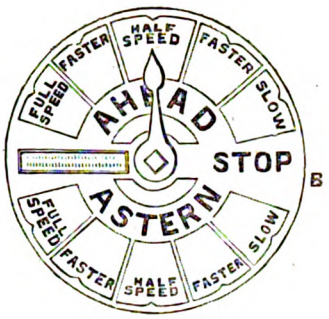


FIG. 1.

FIG. 7.



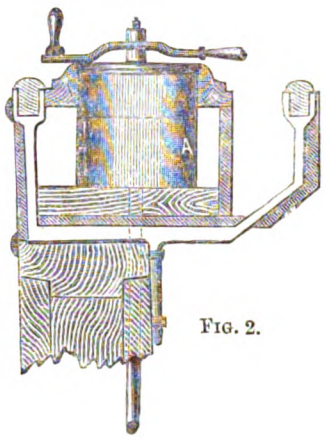
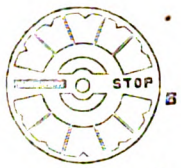


FIG. 2.

FIG. 1.

FIG. 6.



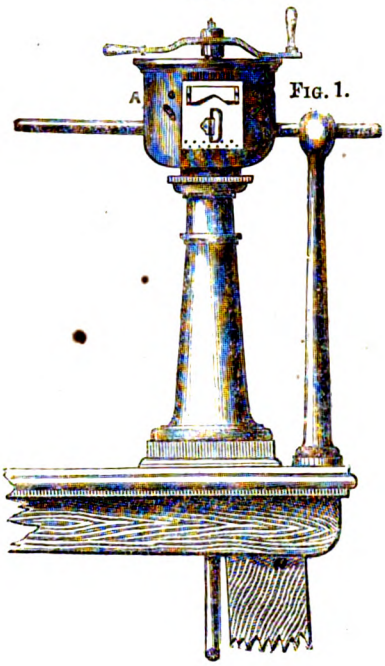
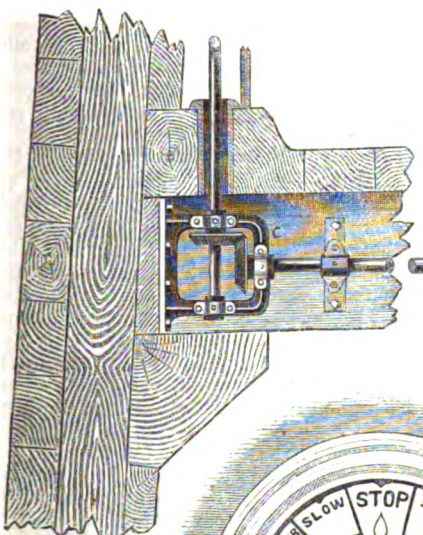


FIG. 1.

FIG. 1.



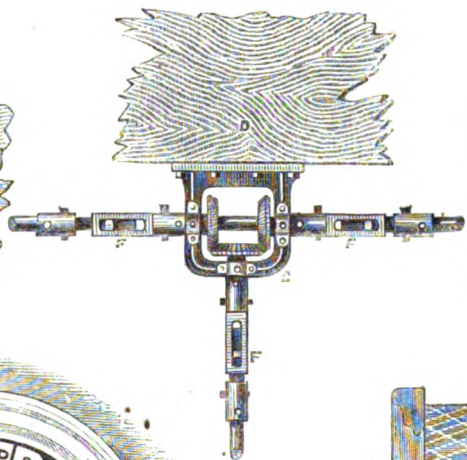


FIG. 1.

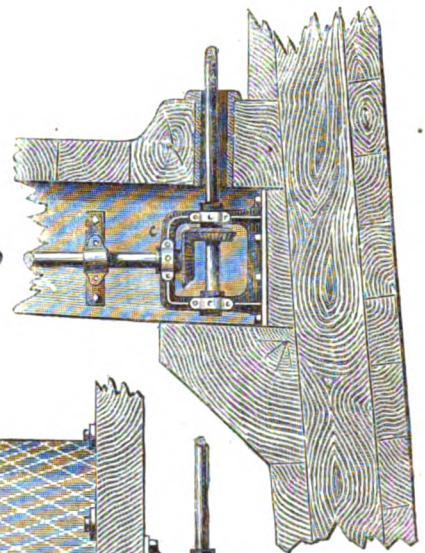
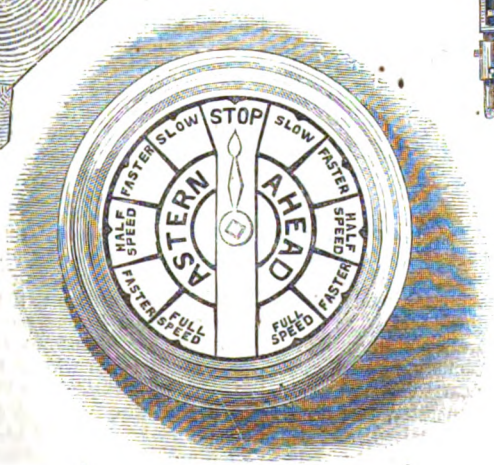


FIG. 3.



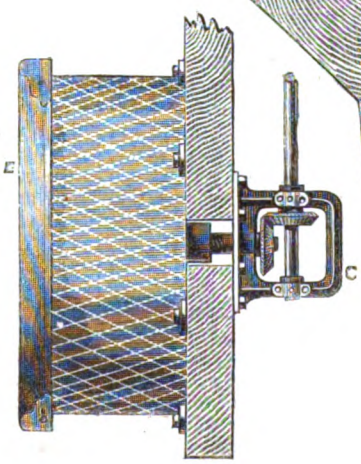


FIG. 4.

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THE CASE OF HENRY CORT, AND HIS INVENTIONS IN THE MANUFACTURE OF BRITISH IRON.

BY THOMAS WEBSTER, M.A., F.R.S., &c., Barrister-at-Law.

XII.

On the 22nd May, 1800, Henry Cort died, and was buried in Hampstead churchyard, having enjoyed only six years the pension of £200 a year granted on the memorial to Wm. Pitt. The extension of a pension of £125 to his widow was not likely to satisfy the sense of justice of those who were reaping the benefit of Cort's inventions without any payment to their benefactor, the rest of the family being left wholly without compensation for the injustice to their father.

At a general meeting of the British Iron Trade, held at the King's Head Inn, Gloucester, on the 29th March, 1811, present the representatives of 14 firms of the principal manufacturers then using the patents for puddling and rolling, a petition was presented by Mr. Robert Thompson, uncle to the late Alderman Thompson, from Elizabeth Cort, the widow of Henry Cort, representing the pecuniary distress of herself and family. The meeting in consideration that the iron trade was much indebted to her late husband for his inventions in the manufacture of iron,

Resolved,—"That a subscription be raised for her relief, that the disposal of the same be referred to a committee of four gentlemen, to consider how it should be converted for the use of herself and family, and that such a subscription be transmitted to the bank of Hill and Co., Stourbridge."

Resolved,—"That such committee shall consist of Mr. Reynolds, for Shropshire; Mr. Robert Thompson, for South Wales; Mr. Gibbons, for Staffordshire; Mr. Butler, for the North."

The list of subscribers composed forty-one firms then using the patents, and the sum subscribed amounted to £871; being a contribution of 30 guineas from one, and 20 guineas from forty firms, in acknowledgement of the enjoyment during twenty years of inventions, which but for the extraordinary circumstances above set forth would probably have yielded to the family a quarter of a million sterling. The firm of Crawshay, Hall, and Bailey, who were prominently indebted to Henry Cort, he having personally superintended the erection of their works from his own plans, assisted by his own workmen, headed the list with the largest subscription. The amount due from that firm under the contract signed by the late Mr. Richard Crawshay, and secreted with the patents and other contracts by the Treasurer of the Navy in 1789, was not far short of £25,000, for iron manufactured from 1789 to 1798, during the subsistence of the patent right.

The amount so subscribed has been occasionally contrasted with the £250,000 which would have been paid in royalties for patent right, and with the much larger amount of profits made by the manufacturer, by reason of Cort's labours during the subsistence of the patents; and contrasts have been suggested unfavourable to the liberality or generosity of the persons engaged in a trade which received so great an impulse from the labours of Cort. But it may be doubted whether this is quite a proper view of the matter; if the contracts and patent rights had been enforced the amount of the royalty, and something probably in addition, would have been added to the trade price of the manufactured iron. The public would have paid in the price of the article the amount which Cort ought to have received as his reward and remuneration. That the iron masters, as a class, are extremely wealthy cannot be doubted, but there have been great periods of depression, and the trade has for a century past been in the hands of a sufficient number to ensure keen competition whenever the profits of manufacture might happen to yield an extraordinary return on the capital employed.

The case of Henry Cort ought to be urged as a claim on and against the nation rather than the iron masters; the nation at large has benefited by his genius and laborious persevering industry; the civilization, the comforts, the convenience, the capacity of the community, has advanced with the manufacture of iron in a most wonderful manner; the Railways, the Britannia Bridge, the Crystal Palace, and the Great Eastern, are types of this advance of the iron age of the last half century.

The iron-masters encouraged Cort's inventions, they were no party to the defalcations and to the gross injustice of the seizing and locking up the patents until after the expiration of their respective terms. The gain from Cort's inventions has been a national gain; the injustice which deprived him of his certain reward was the fraud of public officials; the compensation for such injustice should be a national act.

The meeting at Bristol was followed by a petition to the House of Commons from Coningsby Cort, the eldest son of Henry Cort, as to which the journals (vol. 67, 24th January, 1812, p. 77,) contain the entry, of the petition on behalf of himself and the family of Henry Cort, consisting of a widow and nine other children, being presented to the House of Commons by Mr. Manners Sutton, by command of His Royal Highness the Prince Regent, who recommended it to the consideration of the House.

A Committee of the House of Commons was moved for by Mr. Manners Sutton, then Judge Advocate, and appointed to inquire into the claims of the petitioner. The committee comprised the Secretary to the Treasury, the Secretary to the Admiralty, and the Comptroller of the Navy; the son of the defaulter who had ruined Henry Cort, and whose impeachment had taken place only a few years before, was at the time first Lord of the Admiralty; votes influenced by the relatives of that defaulter were important to the Ministry struggling to carry on a war at a great cost in the face of a powerful opposition. This was an inconvenient, not to say a dangerous, crisis for the renewal of the political agitation attending the impeachment of Henry Cort's destroyer only six years before, a revival which must have led to the inevitable consequence of a full inquiry into the petitioner's claims, involving as it would the merits of Henry Cort and the cause of his ruin.

The case of the petitioner was supported by Mr. R. Hill, brother to Mr. Anthony Hill, the only surviving iron-master who witnessed the introductions of Cort's inventions; Mr. Benjamin Hall, father of Sir B. Hall, the present Lord Llanover, partner in the firm of Crawshay, Hall, and Bailey; and other experienced iron-masters; one witness was called by the chairman in opposition, Samuel Homfray, who attributed the improvement in the iron manufactures to some improvements of his own, founded on, so to speak, and involving the processes of Cort; his "finer's metal," as it was called, being subjected to the puddling process of Cort. Upon such testimony, notwithstanding that Homfray had concurred in the resolutions of the meeting at Gloucester, and been a subscriber to the fund then raised, and had twenty-five years before written the letter already quoted in direct conflict with his subsequent statement, the committee suddenly closed the investigation, excluded all evidence in explanation or refutation of his statements, and reported to the House that though a considerable share of merit was due to Henry Cort they could not satisfy themselves it was sufficient to entitle the petitioner to a Parliamentary reward. The committee further reported, recommending that in consideration of Henry Cort's share of merit the expense of prosecuting the petition should be defrayed by a vote of the House.

It is more than probable that the same political considerations which had led to the hasty and premature closing of the inquiry rendered it advisable that the chairman should not move the vote of the payment of the expenses, amounting to £250, which the committee had recommended, and that all future applications for any investigation of the excluded evidence which might have re-opened the whole question should be discouraged. Certain it is that the House never was moved for the payment of the expenses so recommended, that Mr. Coningsby Cort and the poor applicants had to bear and discharge the expense of the petition, amounting to £250, and that the children of Henry Cort were never able to obtain an inquiry into the voluminous mass of evidence collected within three months of the close of the inquiry from the most eminent men, in refutation of the disengenuous and unexpected statement of Mr. Samuel Homfray.

It cost Mr. Giddy, the chairman of the committee, nothing to state, when this mass of evidence was laid before him, that had it been in time the report of the committee would have been very different; but there was no excuse for his omission of the simple act of justice to move for the payment of the expenses incurred by the petitioners in the investigation, as recommended by the report which he had signed.

Public opinion never acquiesced in the decision of the Committee of the House of Commons upon Cort's claims. The following answer to the application to the Treasury was an evasion of the question, dictated probably by the political considerations already referred to:—

"Treasury Chambers, 14th Aug., 1812."

"Sir,—My Lords Commissioners of His Majesty's Treasury having had under consideration your memorial, dated 31st ultimo, praying that some allowance may be granted to you towards reimbursing the expenses incurred by you in making application to Parliament for a reward on account of the discoveries made by your father in the mode of converting cast iron into malleable iron, and of the rolling it into bars, but which was not granted; I have it in command from their Lordships to acquaint you that your application having undergone the decision of the House of Commons, my Lords cannot exercise a discretion in opposition to the sense declared by the vote of that House.

"I am, Sir, your obedient servant,

"H. Wharton."

"Mr. Coningsby Cort, King-street, Bloomsbury."

The expenses had never been brought before, or the subject of any vote of, the House of Commons, so that the above answer was, on any view, an evasion of the question. The result of the petition to the House of Commons gave no great encouragement to the hopes of adequate compensation or remuneration to the Cort family; the widow, Mrs. Cort, continued to enjoy her pension of £125 until her death in 1816, and after her death a pension of £25 6s. was granted to each of her spinster daughters. Such was the only national acknowledgement

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of the merits and wrongs of Henry Cort until 1856, when by the bounty of Lord Palmerston a pension of £50 was conceded to Richard, the youngest and only surviving son of Henry Cort.

By the exertions of Richard Cort, who after nearly fifty years' service in offices of trust in the Penclawdd Copper, and British Iron, and other companies in succession, public opinion has, through the press, been aroused to the injustice of permitting the only three surviving children of Henry Cort to end their days in a penurious subsistence.

In May, 1855, Richard Cort addressed a memorial to the Treasury, but their lordships declined to re-open a question on which they had adjudicated. The chairman of the council of the Society of Arts, Dr. Booth, in his annual address on the 21st of November, 1855, alluding to the fortunes of the hapless inventor, instanced Henry Cort as one of those "who enrich the nation but beggar themselves," neither he nor his audience being then aware that he had been no victim of ordinary misfortune or ill luck, but had been sacrificed to official delinquency.

Since then the subject has been taken up by many of the most eminent men in the country, and sums of money have been subscribed to enable Richard Cort to press the claims of the three survivors on the attention of the nation. Richard Cort, with an energy and perseverance worthy of his name, has since 1812 endeavoured to rouse a sense of the claims of his family on national gratitude, and not wholly without success, as evidenced by the pension conceded by Lord Palmerston in 1856 already mentioned, upon the report of Sir Roderick Murchison and Dr. Percy, directors of the Metallurgical Department of the School of Mines, on Cort's inventions.

The public press, with singular concurrence and unanimity, has urged the claim of Richard Cort and his two aged spinster sisters on public sympathy and support for their declining years, and greater unanimity of public opinion never existed on any similar question; and on a review of the parliamentary bounties which have been awarded it may be doubted whether any case can present claims comparable to these of Henry Cort. The present occasion is well timed, the nation having at this moment a very large and annually increasing surplus from the funds levied on inventors under the new system of patents.

The official fees paid by inventors during the first seven years ending the 1st of October, 1859, reached an amount greatly in excess of the expenditure during the same period, on objects for which inventors and inventions can derive any benefit, so that the nation now owes to inventors a very large surplus of cash in hand. Can there be a more appropriate application of a portion of the surplus so absorbed by the Consolidation Fund than a bounty to meritorious inventors or their families, who from whatever cause have not derived any adequate reward or remuneration for the benefits conferred on the nation.

This, though pre-eminently an inventor's question, is not without deep interest to all men of science and literature—in fact, to all who live by intellectual labour, in whatever form it may be embodied.

Mr. Fairbairn has recently come forward in the most liberal manner to head a subscription, and a committee of influential persons, for the purpose of securing to Richard Cort and his two surviving sisters, all now between 70 and 80 years of age, some recognition of their claims on the national wealth created by the inventions of their father. The disinterested spirit of generosity and sympathy with which this movement has been undertaken can hardly fail to meet with a response, and to secure at least some acknowledgement of what the nation owes to the father by a suitable provision for the only three survivors of the name of Cort.*

TELEGRAPHS FOR TARGETS.

THE following will, we believe, prove a very useful suggestion:—

GENTLEMEN,—Rifle targets and "butts" are being constructed in great numbers in all parts of the country. It occurs to me that the employment of an electric telegraph to notify the position of each shot would save much time, trouble, and expense, as a substitute for the plan of bugle signals or other modes.

A double wire telegraph laid from the shooting house to the target-man's pit (in front of the targets) would be a small proportionate addition to the expense of a practise ground, and would add much to its completeness and safety.

The ground prepared for the corps to which I belong, "The London Scottish Volunteers," at the Crystal Palace will cost about £500. The plan I suggest is as follows:—A dial and pointer and a bell are to be fixed at each end of the wires, that is, at the shooting house, and in the target-man's pit. When a ball strikes he will with his left hand move a handle that turns the pointer on each dial to the exact *direction* of the hit on the target, that is above, below, right or left, or in the intermediate positions.

With his right hand he will then sound the bell (at the shooting house) by the electric current one, two, three, or four times, as the shot is in the outer. the inner, the third ring, or bull's eye, so as to tell the value of the shot. Yours, &c.

ROB ROY, the Bugler.

Patents for Inventions.

PROVISIONAL PROTECTIONS.

Dated Oct. 31, 1859.

2478. I. Brown. Improvements in the treatment of growing crops.

2482. A. Chevrier. Neutralizing the smell and savour of all vegetable and animal substances without their being adulterated by the use of essence of spirits and aromatical products.

Dated Nov. 8, 1859.

2538. A. Learch. An improved process of manufacturing embossed sheets or stuffs, called embossed fictitious leather for hangings and household furnitures. (A communication.)

Dated Nov. 14, 1859.

2583. H. J. Daniell. Improvements in the construction of breech-loading fire-arms.

Dated Nov. 19, 1859.

2622. C. Bosc. The manufacture of artificial marbles.

2626. J. Hollingsworth. Improvements in the mode of and machinery for cutting irregular and other forms. (Partly a communication.)

Dated Nov. 23, 1859.

2648. W. H. Ward. Improved signal lanterns.

Dated Nov. 25, 1859.

2666. W. Smith. Improvements in applying and working propellers in boats and vessels. (A communication.)

Dated Nov. 30, 1859.

2706. B. Samuelson and W. Manwaring. Improvements in reaping and mowing machines.

2708. E. Dorsett. A new manufacture of heavy oil.

2710. H. de Matthys. Improvements in electric telegraph cables.

2712. W. E. Newton. Improvements in the construction of pianofortes. (A communication.)

2714. J. Lawson and S. Cotton. Improvements in machinery for cutting and forming the teeth or cogs of wheels.

Dated Dec. 1, 1859.

2716. G. K. Geyelin. Making close folding metallic spring laths, mattresses, and bedsteads.

2718. A. Mosselman. An aromal electrical girdle.

2720. J. Cocks. Improvements in the mode of manufacturing cloths or materials for trowserings.

2722. W. E. Newton. Improved apparatus applicable for beating eggs, or mixing substances or liquids. (A communication.)

2724. G. Davidson. Improvements in the manufacture of paper bags, and in the machinery or apparatus used therein.

2726. N. S. Dodge. Improvements in the construction of lamps. (A communication.)

Dated Dec. 2, 1859.

2728. J. Moore. An improved damper of chimneys and flues.

2730. D. Makinson and J. Hope. Certain improvements in carding engines.

2732. W. H. Aldridge. Certain improvements in paddle wheels or propellers of steam ships.

2734. A. V. Newton. An improved mode of treating india-rubber, gutta percha, and analogous gums. (A communication.)

Dated Dec. 3, 1859.

2736. T. Hall. Certain improvements in the construction of cartridges.

2738. F. Palling. Improvements in the construction of lamps for burning oils and tallow.

2742. P. M. Parsons. Improvements in fire-arms and projectiles.

2744. J. Rudkin. Improvements in stoppers for bottles.

Dated Dec. 5, 1859.

2748. J. Hawkins and C. Hawkins. Certain improvements in the construction of furnaces for consuming smoke, applicable to stationary and marine boilers, and other closed fire-places.

2752. G. Feldwick. An improvement in roller blinds.

2754. W. Hutton. Improvements in preventing the destruction of the timbers of piers, docks, and other structures by the action of sea-worms, or other marine animals.

Dated Dec. 6, 1859.

2758. C. Sells. Improvements in marine steam-engines for driving screw and other propellers.

2760. J. Jones and J. Hilton. Improvements in apparatus to be used in dyeing, dunging, soaping, and clearing fabrics.

2764. F. Potts. Improvements in the mode of manufacturing or finishing tubes for certain purposes.

Dated Dec. 7, 1859.

2765. F. Levick. A new or improved coke oven.

2767. J. Anderson. Improvements in obtaining motive power.

2768. T. Bradford. Certain improvements in machinery or apparatus for wringing and mangling textile fabrics.

2769. R. A. Brooman. Improvements in marine steam-engines for driving screw and other propellers, and in screw propellers. (A communication.)

2770. F. W. Schäfer. Improvements in cash, deed, jewel, and other boxes.

2771. R. H. Collyer. A chemical ink-pencil or composition applicable as an instrument or means for writing, drawing, and marking.

2772. M. Jacoby. Improvements in the manufacture of twist lace.

2773. T. R. Harding. Improvements in combs or hackles for combing, carding, or hackling flax, cotton, silk, or other fibrous materials (which are also applicable to raising the nap or pile of woollen or other cloths), and in the making of pins or teeth for such combs or hackles.

2775. C. C. S. de Changy. Improvements in the manufacture of bread, which improvements are also applicable in the preparation of dough or paste for other purposes.

2776. J. Mabbott. Improvements in wind-guards for chimneys.

2777. R. T. Pattison. Improvements in printing and dyeing certain woven fabrics and yarns.

Dated Dec. 8, 1859.

2778. W. Spence. Improvements in rotating harrows. (A communication.)

2779. J. G. N. Alleyne. Improvements in the manufacture of boilers, ships, tanks, and other hollow vessels of iron and steel.

2780. J. Arrowsmith. A new or improved method of constructing land batteries and gun boats.

2781. J. Arrowsmith. Improvements in the manufacture of beams or girders, and in machinery and furnaces used in the said manufacture.

2783. R. Gray and T. H. Scholfield. Improvements in flattening and tempering steel wire and sheet steel, and also in the tubes employed in the furnaces.

* The Committee, of which William Fairbairn is the Chairman, consists of the Mayor of Manchester (Ivie Mackie), Thomas Bazley, M.P., James A. Turner, M.P., Richard Cobden, M.P., Messrs. Whitworth, Hick, Penn, Boyd, and Webster, are soliciting subscriptions with the view of purchasing annuities for, or otherwise securing the comfort of, the declining years of the survivors of the "Cort Family." Mr. David Morris, 1 Market-street, Manchester, acts as Secretary.

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2784. T. Crook. Improvements in machinery or apparatus for making paper bags.
2785. W. Prosser and J. Hogg. An improved cooking apparatus particularly suitable for military purposes.
2786. J. Norris, jun., and T. Till. Improvements in machinery to be used in manufacturing horse-nails and other wrought nails.
2787. F. H. Elliott and C. A. Elliott. An improved method of preventing drawing boards and other flat wooden surfaces from warping or twisting, and of adding to the strength thereof.
2788. A. Rumpff. An improved fastening for portemonnaies, portfolios, bags, and other like articles. (A communication.)
2789. J. Macintosh. Improvements in the manufacture of waterproof and other fabrics, and of moulded or formed articles.
2790. J. Macintosh. Improvements in setting artificial teeth.
2791. J. Macintosh. Improvements in cartridges and projectiles.

Dated Dec. 9, 1859.

2792. W. Boaler. An improved compound for washing purposes.
2793. J. Lawson and W. Hago. Improvements in apparatus to be used in spinning or twisting.
2794. J. Spiller. Improvements in drying articles or bodies formed of plastic clay.
2795. J. Tenwick. Improvements in the construction of steering apparatus adapted for ships and such like navigable vessels.
2796. H. Hughes and J. Moore. Improvements in machinery for transferring and for transferring and engraving designs and figures on to cylindrical and flat surfaces.
2797. J. D. Dunnicliff. An improvement in the manufacture of bonnet fronts and ruches.
2798. W. Betts. An improved manufacture of capsules.
2799. J. Thomson, R. Thomson, and H. Thomson. An improved agricultural implement.

Dated Dec. 10, 1859.

2800. R. Heilman. The preparation of a new colour, called Azaleine, and its application to dyeing and printing. (A communication.)
2801. F. C. Calvert and C. Lowe. Improvements in dyeing and printing certain yarns and fabrics.
2802. G. Davies. An improvement in tobacco pipes, mouthpieces, and cigar or cigarette holders. (A communication.)
2803. W. Horton. An improvement or improvements in steam-boilers.
2804. C. Gammon. An improved fastener for gloves and other articles.
2805. J. Farquhar. Improvements in gas-meters.
2806. W. Whiteley. Improvements in looms for weaving.
2807. J. Chatterton. Improvements in the manufacture of projectiles.
2808. I. L. Bell. Improvements in the manufacture of the sulphate of magnesia.
2809. J. Chatterton and W. Smith. Improvements in insulating telegraphic conductors, and in the treatment of gutta percha.
2810. S. W. Campain. Improved machinery for removing or elevating straw and other agricultural produce.
2811. W. W. Bonnin and F. Pons. A new system and improvements in locomotive engines.
2812. D. Strickland. An apparatus for separating, sifting, sorting, and cleansing mineral ores.

Dated Dec. 12, 1859.

2813. R. Emery. Improvements in carriages for common roads.
2814. J. R. Breckon and R. Dixon. Improvements in the construction of coke ovens.
2815. P. G. Gennerich. A new system of motive power, applicable for working cranes and wheels.
2816. T. Stather. Improvements in the ventilation of buildings, ships, and enclosed places.
2817. P. Stirling. Improvements in traction engines.
2818. G. C. Watson. Novel and artistic bricks or "lumps" for the reception, growth, and propagation of ferns, mosses, and other plants.
2819. G. Lough. An improved compound motive power engine.
2820. G. H. Rollet. An improved machine for the manufacture of pressed bullets.
2821. W. Clay. An improved mode of manufacturing cannon and other ordnance.
2822. J. R. Isaac. Improvements in the construction of hand boxes for travellers.
2823. J. Bailey. Improvements in the manufacture of corsets and stays.
2824. W. Teall. Improvements in treating fatty and oily matters obtained from wash waters. (A communication.)

Dated Dec. 13, 1859.

2825. C. Vinall. Improvements in, and mechanism for, retaining the rollers of window blinds, maps, charts, and other articles requiring to be wound on rollers.
2826. T. Redwood. Improvements in the manufacture of paper and of substances used in paper making, and for other purposes.
2827. G. Withers. Certain improvements in blocks for moulding and shaping glass during the process of blowing or forming glass, for blowing sheet glass, glass shades, and such like articles.
2828. J. R. Johnson and J. S. Atkinson. Improvements in machinery for manufacturing printing types.
2829. W. Harding. Improvements in breech-loading fire-arms and in cartridge carriers.
2830. J. Barling. Improvements in propelling vessels.
2831. W. Robinson. Improvements in cask washing machines.
2833. J. H. Dickson. Improvements in the manufacture of yarns, and in the machinery to be employed in the preparation of certain fibres to be thus manufactured into yarns.

Dated Dec. 14, 1859.

2835. W. Clark. A heating apparatus for boots and shoes and other coverings for the feet. (A communication.)
2837. J. Champion. Certain improved arrangements of spindles, flyers, and bobbins, applicable to machinery or apparatus for preparing, spinning, and doubling fibrous materials.
2839. G. Leach. An improved mode of, and apparatus for, oiling, preparing, and mixing wool.
2841. R. Lawson. Certain improvements in machinery or apparatus for punching patterns or devices upon metallic printing rollers or cylinders.
2843. J. Rhodes. Improvements in steam hammers.
2845. W. Watson. An improvement in preparing indigo for dyeing and other purposes.
2847. W. R. Crocker. Improvements in cutting corks and bungs, and in apparatus employed therein.

Dated Dec. 15, 1859.

2851. B. Predavalle. Improvements in producing or obtaining motive power.
2853. W. Westwood. Improvements in the manufacture and burning of Portland cement.
2855. J. K. Hardy. Improvements in the manufacture of bottle stands.
2857. C. Hancock. Improvements in insulating telegraphic conductors, and manufacturing cables for telegraphic purposes.
2859. D. J. Fleetwood. Improvements in machinery for raising and stamping metal.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

2873. T. Fairbanks. An improved scale for weighing letters. Dated Dec. 17, 1859.
2875. M. Wright. Fastening packing cases by which they cannot be opened without such opening being detected, and termed by him "detective fastening for packing cases." Dated Dec. 17, 1859.
2896. J. Willcock. A new and improved machine for cutting or mincing meat, vegetables, &c. (A communication.) Dated Dec. 20, 1859.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

(*From the London Gazette, Dec.* 27, 1859.)

1867. D. Campbell. Oils.
1873. K. Bühring. Obtaining spring power.
1879. S. Harrison. Broiling meat.
1885. J. Poupard. Blackleading stoves.
1893. H. Medlock. Kilns or furnaces.
1897. A. Yockney. Refining oils.
1898. W. Grimshaw and S. Mason, jun. Machinery for washing, &c.
1900. A. J. Canu. Crushing stones.
1904. P. Salmon. Locomotives.
1911. E. Hardon. Looms.
1912. W. Finegan. Lubricating machinery.
1914. G. W. Petter and T. D. Galpin. Printing presses.
1917. J. J. O. Taylor. Separating silex from iron.
1920. H. Parkes. Cylinders.
1922. O. Maggs. Taps and cocks.
1931. G. Pearson. Boots and shoes.
1933. J. Henry and J. E. H. Andrew. Looms.
1934. J. Blake. Gauges.
1941. A. P. Chamberlain. Cutting corks.
1959. J. Whitworth. Firearms and ammunition.
1960. T. Meriton. Governors.
1963. W. Clark. Sewing machinery. (A communication.)
1971. J. Hare. Pianofortes.
1995. T. Aveling. Locomotive engines.
1997. R. H. Collyer. Paper.
2008. J. F. F. Leroux. Apparatus for taking money.
2028. A. V. Newton. Sewing machines. (A communication.)
2029. A. V. Newton. Weighing machines. (A communication.)
2058. M. M. Jackson. Generating steam.
2135. L. Engler and E. F. Krauss. Insulators.
2179. J. V. Collignon and L. George. Typography.
2187. T. Beards. Ploughing by steam.
2206. E. H. Bentall. Screw presses.
2214. S. R. English. Taking copies of writing.
2417. R. A. Brooman. Oils and fats. (A communication.)
2586. A. Jacquelain. Carbon.
2632. J. Cowan. Furniture.
2638. E. T. Hughes. Weaving. (A communication.)
2643. T. B. Daft. Coating sheathing metal.
2675. F. Scheithauer. Printing fabrics.
2692. C. Sells. Steam-engines.
2720. J. Cocks. Trowserings.
2724. G. Davidson. Paper bags.
2727. W. Betts. Capsules.
2754. W. Hutton. Preventing the destruction of timber.
2758. C. Sells. Marine steam-engines.
2767. J. Anderson. Motive power.
2778. W. Spence. Harrows. (A communication.)
2794. J. Spiller. Drying articles.
2798. W. Betts. Capsules.
2805. J. Farquhar. Gas meters.
2806. W Whiteley. Looms.
2817. P. Stirling. Traction engines.
2830. J. Barling. Propelling vessels.
2873. T. Fairbanks. Scale.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Dec. 23, 1859.

1529. G. Redrup.
1536. C. W. Williams.
1532. R. Dick.
1541. J. M. J. Baillie.
1545. W. and J. Wray.
1549. W. J. T. Williamson.
1557. R. A. Brooman.
1567. B. Standen.
1579. R. W. Morville.
1601. J. Luis.
1656. W. A. Munn.
1761. C. Kingsford.
1765. J. H. Johnson.
1781. W. E. Newton.
2423. F. N. Clerk and C. Thomas.
2445. J. Z. Kay.
2511. L. Koch.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

3023. W. J. Payne.
3028. T. L. Thurlow.
3029. W. H. Stratton.
3030. J. Redgate, E. Ellis, and J. Cropper.
3034. W. B. Johnson.
3044. J. Lark.
3054. W. Taylor.
3055. J. S. Barraclough.
3060. C. S. Rostaing.
3079. J. Petrie and W. McNaught.
3082. G. Ritchie.
3102. W. Bray.

PATENTS ON WHICH THE SEVENTH YEAR'S STAMP DUTY HAS BEEN PAID.

1121. G. Beadon.
1127. J. Roydes.
1161. G. Bower.
1180. W. Busfield.
1192. A. D. Brown.
1853—21. J. B. Pascal.

LIST OF SPECIFICATIONS, &c.,

Published during the week ending Dec. 24, 1859.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s d		s d		s d		s d		s d		s d
9210	5	1221	0	3	1230	0	3	1238	0	8	1246	0	3	1254	0	3
1214	0	10	1223	0	9	1231	0	7	1239	0	5	1247	0	4	1255	0	3
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1217	0	3	1226	0	3	1234	0	3	1242	0	10	1250	1	1			
1218	0	3	1227	0	10	1235	0	3	1243	0	6	1251	0	10			
1219	0	9	1228	0	7	1236	0	3	1244	0	7	1252	0	3			
1220	0	3	1229	0	10	1237	0	7	1245	0	3	1253	0	5			

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 27. [NEW SERIES.]

LONDON: FRIDAY EVENING, JULY 1, 1859.

PRICE, FOURPENCE. BY POST 5d.

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" Proctor and Taylor, Milbank Forge, Hartlepool,
" Henry Wood and Co., Goree Piazzas, Liverpool,
" Wood Brothers, Chester, Wolverhampton, and Stourbridge,
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One of 14-horse power, 12in. cylinder, and 36in. stroke.
Two of 14-horse power, 14in. cylinder, and 24in. stroke.
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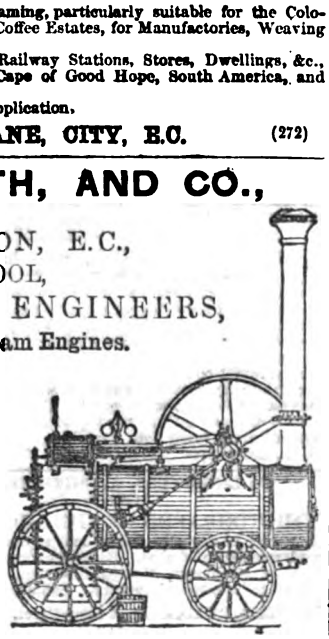

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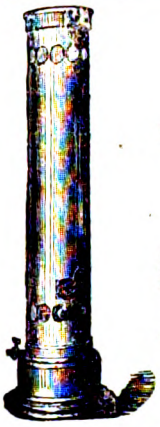

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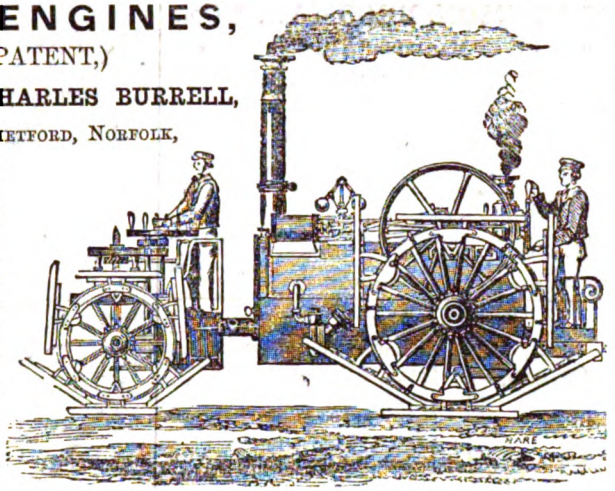

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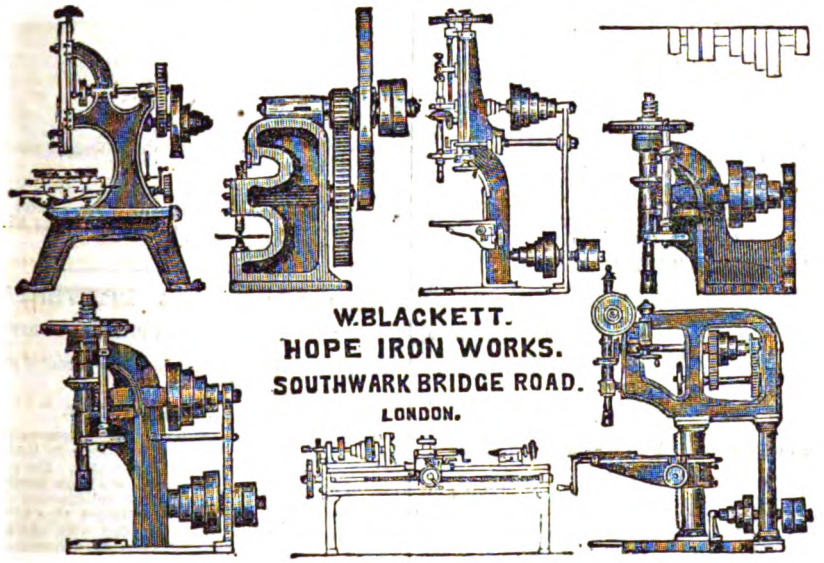

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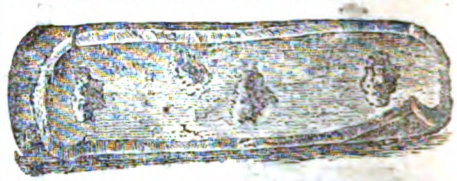

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The Gutta Percha Company have been favoured with the following letter,

From Dr. MURRAY, Hull.

"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha Tubing. Nothing can be better. I have also recommended it to others, who have adopted the expedient."

A variety of Gutta Percha Articles, such as Mill Bands, Tubing, Sheet, Soles, Pump Buckets, Bosses, Union Joints, Bottles, Bowls, Flasks, Curtain and Cornice Rings, Solid Frames, Galvanic Batteries, &c., &c.

MANUFACTURED BY THE

Gutta Percha Company, Patentees,

18 WHARF ROAD, CITY ROAD, LONDON,

AND SOLD BY THEIR

WHOLESALE DEALERS IN TOWN AND COUNTRY (29)

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THE ATLANTIC TELEGRAPH COMPANY.—(Incorporated by Special Acts of Parliament, whereby the liability of each Shareholder is strictly limited to the amount individually subscribed for by him.) Five Pound Shares. Issue of Preferential Shares. Guaranteed 8 per Cent. by Her Majesty's Government on the conditions herein specified. Fixed income on the Cable when in work from the Governments of Great Britain and the United States, £34,000 per annum, irrespective of mercantile and other messages. Special advantageous Traffic arrangement with the entire Telegraphic System in America.,

£500,000 in Guaranteed Preferential Shares of £5 per Share, 10s. per Share payable on application, and a further sum of £2 per share on allotment.

DIRECTORS.

CHAIRMAN—The Right Hon. JAMES STUART WORTLEY, Upper Sheen House, Mortlake.
VICE-CHAIRMAN—C. M. LAMSON, 64 Queen-street, Cheapside, London.
Samuel Gurney, M.P., 65 Lombard-street, London.
Francis Le Breton, 3 Crosby-square, London.
J. W. Brett, 2 Hanover-square, London.
W. Brown (Messrs. Brown, Shipley, and Co.), Liverpool.
Robert Dalglish, M.P., Glasgow.
Capt. A. T. Hamilton, 12 Bolton-row, Piccadilly.
George Peabody, 22 Old Broad-street, London.
John Pender, Mount-street, Manchester.

SECRETARY—George Saward.
BANKERS—The Bank of England.
SOLICITORS—Freshfield and Newman.

Communication by Electric Telegraph between Great Britain and America is no longer a theoretical proposition, but an accomplished fact.

The development of this enterprise—one of the greatest of modern times—is entirely due to the Atlantic Telegraph Company.

In consequence, however, of the accidents and injuries to which the first Cable was subjected before its final and successful submergence, a considerable loss, and still greater disappointment, have resulted to the original Shareholders; but the Directors are sanguine as to the permanent success which awaits their future exertions.

The Subscribers to the Preferential Capital now about to be issued will not be affected by the losses of the first proprietors.

The Preferential Capital will consist of 120,000 Shares of £5 per share.

It is proposed to call up 50 per cent. of this amount, viz., 10s. per Share to accompany the application for the Shares, and a further sum of £2 per Share on allotment.

These Shares will have all the privileges of guaranteed Preferential Shares in the Atlantic Telegraph Company, under the following resolution of the Extraordinary General Shareholders' Meeting of June 8, 1859.

Resolved—"That the said Capital of £600,000, or so much thereof as may from time to time be issued shall be and is hereby constituted Preferential Capital of the Atlantic Telegraph Company, and the Shares therein shall be entitled to receive upon the amounts from time to time paid up, a Dividend of 8 per cent. per annum, payable half-yearly, out of the balance of profit in each half-year.

"That after 8 per cent. shall have been paid on such Preferential Shares, all the old capital of the Company shall next become entitled to a dividend of 4 per cent.

"That after such 8 and 4 per cent. shall have been respectively provided for, the whole capital of the Company shall participate equally, pro ratâ, in any additional profits."

The dividend on the Preferential Shares is ensured by the guarantee of the British Government of 8 per cent. per annum for twenty-five years on all amounts called up and employed not exceeding £600,000, the conditions being that the Cable shall be laid and work successfully.

In case of temporary suspension of working, from injury to the Cable or other causes, the Government will allow a liberal time for its restoration, during which time they will continue their guarantee.

The dividend during the time the Cable is successfully at work is further secured by subsidies amounting to £20,000 a-year from Her Majesty's Government, and 70,000 dollars or more than £14,000 a-year from the Government of the United States.

The Company's minimum secured or absolute revenue, therefore, without taking into account the great receipts that may be expected from commercial and other messages, will be £34,000 a-year, commencing from the day when the Cable is successfully laid.

The connexion which has already been established between this Company and the New York, Newfoundland, and London Telegraph Company secures a full participation in the valuable privileges and traffic arrangements possessed by them over all the telegraphic systems in British North America and in the United States.

In addition to the fixed annual subsidies already spoken of, the Atlantic Telegraph Company will, by means of this connexion, enjoy special advantages with reference to reductions in Tariff, and special facilities for the transmission of "through" passages over the whole Continent of America, enabling them to serve the public in a manner that cannot be competed with, and at a profit to themselves which could not be attained by any other Company.

The construction of the next and future Cables will, in many essential particulars, differ from that of the first.

The experience now possessed by the Company of the course along which the Cable has been laid, and which is the only line across the Atlantic Ocean hitherto demonstrated to be practicable for submerging a Telegraph Cable, is of the greatest value.

The further experience of this Company in the electrical and other phenomena developed by them on the longest of all Telegraphic Cables, will, it is believed, result in the working of messages at twice the rate that has lately been expected from an Atlantic Cable.

The Directors will enter into no engagement or contract without seeking the mature advice of the highest scientific and practical authorities in this country and in America, with whom they are in treaty, and whose names will shortly be published. This will enable them to decide with confidence upon the external form and construction of the Cable, its specific gravity, its insulation, and the size of its conductor.

The Directors are fully alive to the importance of a prudent economy, and it is expected that a sum far less than that which power has been taken to raise will be ample to cover the manufacture, insurance, and submersion of the Cable; but the first object of the Directors will be to secure the most perfect and the best manufactured Cable that can be constructed.

Proposals have already been received from respectable contractors, which, if accepted, will ensure the manufacture of the new Cable at the smallest cost consistent with efficiency and durability. These offers are such as would ensure, under the protection of effective penalties, its careful submergence and its efficient working for one month.

As a further precaution, the Directors contemplate being able to take out a policy of insurance to cover the risk of the successful submersion of the Cable from shore to shore.

The earliest operations entered into will be directed to an endeavour to resuscitate or raise the old Cable, for which purpose the Directors have obtained permission from the Government to employ, in the first instance, a sum not exceeding £20,000 out of the new guaranteed capital. If successful in these endeavours, the British Government consent to commence at once to pay £14,000 a-year, which they will increase to £20,000 when a new Cable is laid, whether the effort to resuscitate the old Cable be successful or not. The subsidy of 70,000 dollars per annum from the United States Government will also commence at once if the attempts to restore the old Cable are successful.

The Directors will not commence any works nor conclude any contracts till the amount of new 8 per cent. Preferential Stock subscribed for reaches £300,000; and they undertake that, if the subscriptions do not amount to that sum at least, they will return to the Subscribers the deposit advanced by them, deducting only the trifling sum per Share incurred in the preliminary expenses attendant on the issue of this new capital, and any portion of the £20,000 which may have been expended in attempting to raise or resuscitate the old Cable which shall not be balanced by the value of the Cable so recovered.

It is believed by the Directors that, under the foregoing proposed arrangements, a very promising investment is offered to the original Shareholders and to the public, and that the accomplishment of the great work is thereby rendered to a large extent secure and certain.

Applications for Shares will be received in the form set forth below, addressed to the Secretary of the Company, at the offices, 22 Old Broad-street, E.C., London; the first deposit of 10s. per Share being at the same time remitted to either of the undermentioned bankers. This amount will be returned in full, if the shares are not allotted.

By order,
GEORGE SAWARD, Secretary.

22 Old Broad-street, London, 1859.

SUMMARY OF PROSPECTUS.

1. Total issue, £600,000 in Shares of £5 each.
2. Guarantee of 8 per cent. per annum from the British Government, to commence on the opening of the Cable to the public.
3. After the 8 per cent. is paid to the Preference Shares, and 4 per cent. on the old capital, the Preference Shares are to divide the balance of profit, pro ratâ, with the old capital.
4. Subsidy of £20,000 per annum from the British Government.
5. Subsidy of 70,000 dols., or more than £14,000 per annum, from the United States Government.
6. Security, under a special contemplated policy of insurance, against the entire or partial loss of the Cable during submersion.
7. Offer of contractors to make, and lay down, and work the Cable successfully.
8. Advantageous agreement with the New York, Newfoundland, and London Telegraph Company, whereby special facilities for traffic are secured over all the telegraphic systems in America, and reductions of tariff over many of them.
9. Return of deposits to subscribers if the capital subscribed is inefficient.

BANKERS (who will receive deposits).
LONDON—London and Westminster Bank.
LIVERPOOL—Bank of Liverpool.
MANCHESTER—Union Bank.
GLASGOW—Union Bank of Scotland.

APPLICATION FOR SHARES IN THE PREFERENTIAL CAPITAL OF THE ATLANTIC TELEGRAPH COMPANY.

Five Pound Shares.—8 Per Cent. Guaranteed.

To the Directors of the Atlantic Telegraph Company.

Gentlemen,—Having this day paid to the Company's Bankers the sum of £ , being 10s. per Share now applied for, I request you to allot me Shares of Five Pounds each in the Guaranteed Preferential Capital of the Atlantic Telegraph Company on the conditions stated in the prospectus; and I hereby undertake to pay the further deposit of £2 per share thereon immediately on allotment, and the future calls as and when they are made by the Directors. It being understood that no further calls are to be made until the minimum amount of £300,000 has been subscribed for, and that the deposit (less the proportion of expenses thereon, according to the conditions of the Prospectus) shall be returned to me in case the said amount is not subscribed for.

Name.....
Address.....
Profession or description.....
Date .....

Reference to.....
Of.....

N.B.—A reference will, in all cases, be required where the applicant is not a Shareholder, or already known at the Office or to the Directors.

Applications to be enclosed to the Secretary, GEORGE SAWARD, 22 Old Broad-street, London. (299)

RAILWAY AXLE-BOX COMPANY continue to grant Licenses to manufacture and use AXLE-BOXES under their PATENTS, which include those of Messrs. ADAMS and RICHARDSON, WRIGHTON, NORMANVILLE, VIGURS, and others.

These are the only AXLE-BOXES that effectually EXCLUDE DUST, and prevent the escape of grease, by which an important saving is effected in the wear and tear of the JOURNALS and BEARINGS and the CONSUMPTION OF GREASE.

Further particulars and Licenses may be obtained of
P. M. PARSONS, Manager.
9 Arthur-street West, London-bridge, E.C. (283)

FOR INVALIDS. — INDIA-RUBBER WATER BEDS, PILLOWS, and CUSHIONS. Also Inflating Bed-chairs, Air Beds, Pillows, Bolsters, and Air Cushions made any size or design. Price Lists post free on application.—JAMES LYNE HANCOCK, Vulcanized India-Rubber Works, Goswell-mews, and 8 Goswell-road, London, E.C. (257)

RANSOME'S PATENTED PROCESS FOR PRESERVING STONE, CEMENT, STUCCO, &c. —By this process the softest and most friable Stone, Cement, or Stucco, can be rendered Impervious and Imperishable, DECAY AT ONCE ARRESTED AND PREVENTED.

For Particulars, Specimens, Illustrations, and Agencies, apply to Mr. Frederick Ransome, Whitehall Wharf, Cannon-row, Westminster; or Patent Stone Works, Ipswich. A Liberal Discount allowed to the Trade or to Shippers. (175)

BY HER MAJESTY'S ROYAL LETTERS PATENT.
PATENT SPHERICAL SELF-ADJUSTING BEARINGS, which do not heat in work. The advantages possessed by these Bearings are:—

1st. They are Self-adjusting; and, consequently, can be put down by the most ordinary Mechanic.
2nd. They are not liable to heat, even at high speeds.
3rd. They remain constantly parellel to the Spindle; and, therefore, wear equally all across the Bearing.
4th. They require only a very small quantity of oil.

Engravings and Prices forwarded on application to the Patentees.

WALLIS & HASLAM,
Engineers and Iron Founders, North Hants Iron Works, Basingstoke. (121)

EMIGRATION TO NEW YORK, CANADA, AUSTRALIA, NEW ZEALAND, EAST INDIES, CAPE OF GOOD HOPE, &c. All Classes of Passengers booked throughout in the Finest Steam and Sailing Packets. Full Particulars in our circulars for 1859, may be had gratis on application to F. S. GRAY and Co., 54 King William Street, City, and 6 Tower Hill, London; and at 25 Bath Street, Liverpool. (187)

BRASS AND COPPER TUBES.
MUNTZ'S PATENT SOLID ROLLED BRASS AND COPPER TUBES, now extensively used on the principal Home and Foreign Railways, and for Marine Boilers by the Government and leading Steam-Packet Companies, are cheaper and more durable than the ordinary tubes.

Address, GEORGE RICHARDSON and CO.,
1 New Broad-street, E.C. (277)

MATHEMATICAL DRAWING INSTRUMENTS, RULES, TAPES, CHAINS, LEVELS, THEODOLITES, BOX SEXTANTS, PRISMATIC and POCKET COMPASSES. Price Lists of the above articles sent post free, by JOHN ARCHBUTT, 20 Westminster Bridge Road, Lambeth, near Astley's Theatre. Every article warranted, and the prices will be found considerably lower than ever before charged for articles of similar quality. Routledge's Engineers' Slide Rules, 4s. 6d. each; Hawthorn's ditto, 5s. 6d.; Carpenters' Rules from 1s. (148)

PUMPING MACHINERY.
GWYNNE AND Co., Engineers, London, manufacture and supply the following Machinery, of the most approved construction and with all the latest improvements:—Portable and Fixed Steam-Engines and Boilers of every description; Waterwheels, Windmill Horse and Hand-power Machines; Pumping Machines for the Supply of Towns, Cities, and Districts, and for the Irrigation of Coffee, Cotton, Indigo, Sugar-cane, and Rice Estates, for pumping out Coffer-dams, Canals, Dry Docks, Reservoirs, &c. They also manufacture and supply the Pumping and other Machinery for Paper, Pulp, and Fulling Mills, Breweries, Distilleries, Tanneries, Starch Works, Bleaching, Dyeing, and Calico Printing Works, Chemical Works, Silk, Cotton, and Flax Mills, and Manufactories in general. All Letters not paid will be refused. Illustrated Price Lists forwarded on receipt of Six Postage Stamps. —GWYNNE AND Co., Hydraulic and Mechanical Engineers, Essex-wharf, Strand, London.

For Exportation.—The above can be obtained through British Merchants, Shippers, and Colonial Agents. (24)

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T. SUFFIELD AND CO.

Call the particular attention of

SHIP-OWNERS, SHIP-BUILDERS, AND COMMANDERS OF STEAM AND SAILING VESSELS,

to the Simple and Efficient Arrangements of their

PATENT PUMPS AND FIRE-ENGINES,

Both Fixed and Portable, with PATENT VALVES and other Improvements.

These Pumps are free from that liability to choke which is common to other Pumps, and their Working Parts are not susceptible of derangement either from wear or from being long out of use. They pass entirely through them, with ease, any substance that may enter the Suction Pipes. The Novelties in these Pumps are their adaptation to the varied duties of Ships' Pumps; the facilities they afford for Cleansing the Suction Pipes, and for Sounding or Examining the Valves; the readiness with which they may be used for Ventilating the Bilge, or for acting as a Syphon either for Watering the Ship, or for extinguishing Accidental Fires on board: the rapidity with which they can be converted into Fire Pumps, or be applied to the Washing of Decks; and their capability of Pumping from Several Compartments. Also, to their

MARINE ENGINE-ROOM TELEGRAPHS,

Which excelled all others in the recent series of Trials in Her Majesty's Navy at Sheerness. These invaluable instruments have been supplied and sent to almost all parts of the world, and in no case has there been any complaint of their working.

Testimonials, bearing uniform evidence of the complete success of these Telegraphs, may be had upon application.

IMPROVED ENGINE-ROOM COUNTERS,

Suitable for testing the speed of all classes of machinery.

IMPROVED

HYDROMETERS, SALINOMETERS,

With Coolers and Dippers for same. Injection Tallow-Cocks, and various kinds of Syringes.

IMPROVED MARINE DISTILLING APPARATUS,

Which will be found both Simple and Efficient for the Distillation of Fresh from Salt Water.

IMPROVED SHIPS' WATER-CLOSETS,

Made to act when placed either above or below the water level. These Closets are simple, efficient, and mechanically arranged for their various requirements, and are not liable to derangement.

IMPROVED STEAM COCKS, WATER GAUGES,

And all kinds of Steam Fittings of the very best quality. As a large Stock of every variety of this class of goods has been much sought after, we trust the present one (especially considering it can be so readily examined in our new premises) will be fully appreciated and meet with the attention it deserves.

GRAUTOFF'S IMPROVED STEAM AND VACUUM GAUGES

(For which we are the sole appointed Agents) and which after having been tested for some time, are now patronised by the Lords of the Admiralty. Besides BOURDON'S and other Guages which are also supplied by us to order.

IMPROVED STEAM WHISTLES, LUBRICATORS, LAMPS, OIL FEEDERS,

And Stores of every description are supplied by us on the shortest notice.

T. SUFFIELD & CO.

Being practical Brass Manufacturers, Copper Smiths, Plumbers, Engineers, and Gun Metal Steam Cock Makers, are in a position to undertake and carry out with very great dispatch and economy all orders entrusted to them. In PAINTING and DECORATIVE Work also, lengthened experience enables them to compete most successfully with others, and they are at all times most ready to furnish estimates for this class of work when required to do so.

T. SUFFIELD AND CO.

Also respectfully solicit the attention of STEAM SHIP BUILDERS and OWNERS to their Large and Varied STOCK of

ASSORTED STORES FOR MARINE PURPOSES.

They keep a Large Stock of Goods, of their own Manufacture and from the Best Makers, constantly on view; so that by a visit to their Works or Depôt, much valuable time may be saved by Managers, Engineers, and other Gentlemen who may require such Stores, together with a further saving in the cost of such Articles.

DEPOT, 116 FENCHURCH STREET, E.C.,

(OPPOSITE MARK LANE.)

MANUFACTORY, 12 & 13 BERMONDSEY WALL, S.E.

LONDON.

(15)

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MEDALS AWARDED TO

THOMAS GLOVER'S PATENT DRY GAS-METERS.

VIZ.:

GREAT EXHIBITION, LONDON, 1851. | NEW YORK EXHIBITION, 1855.
AND PARIS UNIVERSAL EXHIBITION, 1855.

LONDON, March 25, 1859.

THOMAS GLOVER takes this opportunity of thanking Gas Companies and his other Customers for the very liberal support and patronage he has received during the past year, which has far exceeded his most sanguine anticipations, having sold a greater number of his PATENT DRY GAS-METERS since the dissolution of his partnership with Mr. Croll than he was ever previously enabled to do in any one year.

THOMAS GLOVER confines his sole attention to the business of Gas-Meter Making. The propriety of his doing so is satisfactorily proved by his success; and, without the practice of any quackery, or any attempt to delude the public by an absurd exhibition of "Old and New Valves," his Meters are in general use by the Metropolitan Gas and other Companies in this Country and abroad. For example, one Metropolitan Company have now in use above **12,500** of his Patent Dry Gas-Meters; some of these Meters have been fixed for Fourteen Years, and are still in working order, without complaint from either the Company or the Consumer.

THOMAS GLOVER thinks it necessary to put Gas Companies on their guard against parties selling Patent Dry Gas-Meters constructed in imitation of his, but unskilfully made on erroneous principles, and with improper and unsuitable materials.

THOMAS GLOVER'S Workshops are now the most extensive in this or any other country, and he is thereby enabled promptly to execute orders to any extent required. Purchasers may at any time inspect his Works and the Materials of which his Meters are constructed. He is ready to enter into Contracts with Gas Companies and others to uphold their Stock of his Meters for Twenty Years at an annual charge varying from 2½ to 5 per cent., and to leave always in the hands of Gas Companies Three Years' charge for upholding, as a guarantee for the fulfilment of the Contract.

THOMAS GLOVER,
PATENT DRY GAS-METER MANUFACTURER,
SUFFOLK STREET, CLERKENWELL GREEN, AND
ALLEN STREET, GOSWELL STREET, E.C. (293)

D. HULETT & CO.,
55 and 56 HIGH HOLBORN, LONDON,
Patentees and Manufacturers of the only good Mercurial Gas Regulator,

INVITE the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

Manufacturers of
GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;
Double Cone, Albert, Shadowless, and every description of Burner, Union Jets, Batswings, &c.;
IMPROVED FULL-WAY CARTER'S VALVES (much approved of);
GAS-STOVES, and every article connected with Gas-Apparatus.
CAST AND WROUGHT-IRON PIPE, BLACK AND GALVANISED. COPPER, TIN, BRASS, AND COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER,
for clearing out Mains, Services, and Interior Fittings—60s. net.

BOYLE'S PATENT SILVERED GLASS COMBINATION REFLECTORS AND OUTSIDE LANTERNS.
Sole Manufacturers of CHURCH & MANN'S PHOTOMETER.
Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s. (294)

THE IMPERIAL IRON TUBE COMPANY,
(SUCCESSORS TO GEORGE B. LLOYD & CO.)
GAS STREET AND BERKLEY STREET,
BIRMINGHAM,
Manufacturers of Wrought Iron Tubes & Fittings,
FOR GAS, STEAM, AND WATER.
PATENT GLASS ENAMELLED AND GALVANIZED TUBES,
AND
LAP-WELDED IRON BOILER TUBES.
(193)

TO STEAM SHIP OWNERS, ENGINEERS, AND OTHERS.

How's Patent Steam Engine Counters, can be read at sight.
These Counters register the number of revolutions made by an engine or other mechanism. They may be used for ascertaining the duty of Pumping Engines and Water-wheels; the revolutions on board a steam-vessel; to calculate the slip of the propeller; and in a locomotive to test the slip of the wheels.

How's Patent Salinometer, for Steam Boilers using Salt Water.
By these, the density of the water in the Boiler is at all times accurately shown, and a saving of boiler and fuel is effected. They are adopted by the Admiralty, the Honorable Trinity Corporation, and others. Copies of Testimonials from Messrs. Penn, Messrs. Maudslay, and others, will be forwarded on application.

How's Engine-Room Telegraph, for communicating between Captain and Engineer. Society of Arts Prize Medal, 1855.
is a Mechanical Telegraph, and by its peculiar construction, error or misunderstanding is rendered impossible. It now extensively adopted, and gives great satisfaction.

How's Patent Fresh Water Apparatus for Ships' Use.
This apparatus is designed for the distillation of Fresh from Salt Water; and on long voyages, and where the supply of water is scanty, it will be found invaluable. Testimonials may be seen.

Patent Steam Pump and Fire-Engine for Ships' Use.
This Steam-pump occupies but a small space; works perfectly noiselessly, and throws an immense volume of water. An Illustrated Circular of Fresh Water Apparatus and Steam-pump combined, free on application.

How's Patent Machine for Cutting Bolts, Rods, Spindles, Wire, &c.
Simple in construction, inexpensive, occupies but little space, and will not easily get out of order.

A Pamphlet Illustrative of the above, sent free by post, on application to

A. P. HOW, ENGINEER,
81 MARK LANE, LONDON.
EVERY DESCRIPTION OF ENGINEERS' TOOLS, ENGINE ROOM STORES, &c. &c., SUPPLIED. (89)

VINEGAR.—Patronised by Her Majesty's Government.

CONDY'S PATENT PURE CONCENTRATED MALT VINEGAR.

Families, by using this delicious VINEGAR, insure purity and effect a saving of 50 per cent. See "Report of Dr. Letheby, City Officer of Health, Dr. Hassall, of the 'Lancet' Commission, and others." Sold by the Trade, in Bottles, labelled and capsuled. Wholesale—63 King William-street, London-bridge, E.C. Six Quart Samples sent free to any Railway for 3s. 6d. (216)

ARTESIAN WELLS, BORING TOOLS, PUMPS, &c. Engineers, Architects, Surveyors, Builders or others requiring a good supply of Water may have any quantity procured by W. SPELLER, 14 York-street Blackfriars'-road, London, where may be had any quantity of Tools for Sinking or Boring, from 2 to 20 inches diameter, and from 100 to 2,000 feet depth; also Men and Tools to bore for Railroads, Minerals, &c., in any part of the world. Boring Tools and suitable Pipes for exportation, with full instructions for their use.

Builders, Contractors, Brickmakers, Barge and Ship Builders, and others, can be supplied with Wrought or Cast Iron Pumps, Double or Single, for excavation of Deep Wells, from 3 to 14 inches in the bore, and from 6 to 130 feet in length, to work by hand or Steam Power.

Hot-Water Apparatus for Conservatories, &c., on the most economical and improved principles.

Also Manufactory for Captain John Grant's much improved Cooking Apparatus. (44)

GLADSTONE & Co., CONTRACTORS and ENGINEERS.
2 John-Street, Minories, London, E.C.,
Are prepared to ESTIMATE FOR and CONSTRUCT BRIDGES, PIERS, JETTIES, &c., in Iron, Wood, or Stone. Also to supply Cranes, Girders, Turntables, and Railway Work and Plant generally. (199)

NOTICE OF REMOVAL.

WILLIAM DRAY AND CO,
FROM SWAN LANE TO
ADELAIDE PLACE, LONDON BRIDGE.
(227)

SPIRAL TUBE BRUSHES made with Wire or Whalebone for Tubes of
1½ 1¾ 2 2¼ 2½ 2¾ 3 3½ 4 4½ 5 ins. diam.
24/, 25/, 26/, 28/, 30/, 32/, 35/, 38/, 42/, 46/, 50/ per doz
Quantities of Two Dozen and upwards delivered in London.
WILLIAM WALLER, Uddingston, by Glasgow. (213

VOKINS & HURD,
SEYMOUR HOUSE, JUBILEE PLACE, CHELSEA.
HOT-HOUSE BUILDERS
AND
Hot-Water Apparatus Manufacturers.
Plans and Estimates forwarded on Application. (149)

CHUBB'S LOCKS, FIREPROOF SAFES, CASH AND DEED BOXES.
Complete lists of sizes and prices may be had on application
CHUBB AND SON,
57 ST. PAUL'S CHURCHYARD, LONDON;
28 Lord-street, Liverpool; 16 Market-place, Manchester and Wolverhampton. (4)

GLENFIELD PATENT STARCH,
USED IN THE ROYAL LAUNDRY.
AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.
WHEN YOU ASK FOR
GLENFIELD PATENT STARCH,
SEE THAT YOU GET IT,
as inferior kinds are often substituted.
Sold by all Chandlers, Grocers, &c., &c. (75)

THE
SILVERTOWN INDIA-RUBBER WORKS
OPPOSITE
H. M. DOCKYARD, WOOLWICH.

INDIA-RUBBER MANUFACTURES
WITH ALL
RECENT IMPROVEMENTS.
Warehouses, 3 and 4 Bishopsgate Within, E.C. (145)

ISCA FOUNDRY COMPANY, OLD BARRACKS, NEWPORT, MON.
ENGINEERS, AND RAILWAY WAGGON BUILDERS.
Manufacturers of Switches, Points, and Crossings, Chairs, Spikes, Bolts, and General Railway Fittings. 279)

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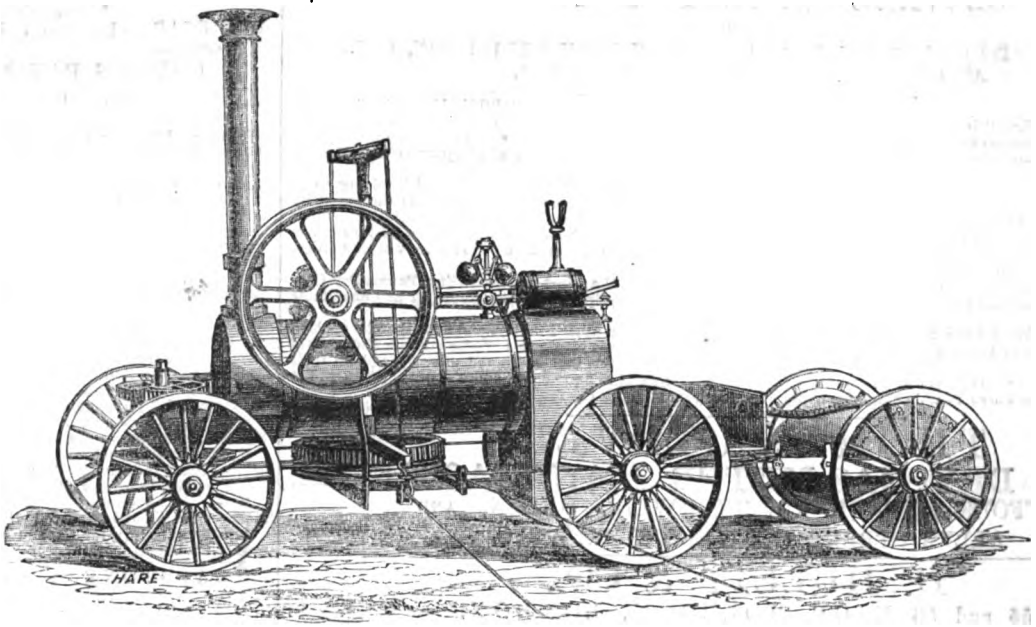
FOWLER'S PATENT STEAM PLOUGH.



CUT OF FOWLER'S ENGINE, WINDLASS, AND WATER-CART.

ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching Plough, and Scarifier.

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CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

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They may be seen at work at the Establishment of the Manufacturer,

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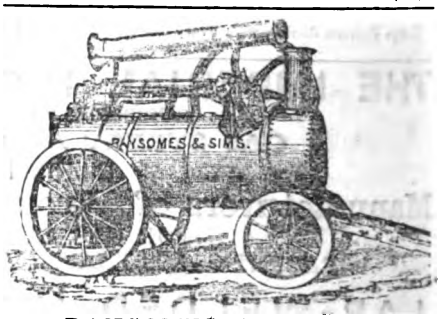

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 28.
[NEW SERIES.]

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PRICE, FOURPENCE.
BY POST 5d.

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Parties desiring to submit Tenders may, upon payment of £3, obtain plans, sections, specification, form of tender, and other particulars, on application at the Office of the Board, between the hours of Nine a.m. and Four p.m.

Tenders addressed to the Metropolitan Board of Works, must be delivered at the Office of the Board, No. 1 Greek-street, Soho, before Four o'clock p.m., on Thursday, the 21st day of July inst., and no Tender will be received after that hour.

The Board do not bind themselves to accept the lowest or any Tender, and the party whose Tender shall be accepted will be required to provide two approved sureties for the due performance of the work.

E. H. WOOLRYCH, Clerk of the Board.
No. 1 Greek-street, Soho, July 2, 1859. (305)

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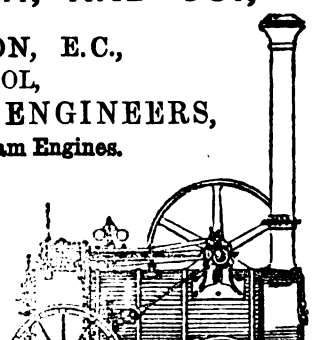

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AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

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A TREATISE on HYDROSTATICS and HYDRODYNAMICS. By W. H. BESANT, M.A., Fellow and Assistant Tutor of St. John's College, Cambridge.

Cambridge: DEIGHTON, BELL, and Co. London: BELL and DALDY. (310)

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HIGH SPEED STEAM NAVIGATION AND STEAM-SHIP PERFECTION. Can perfection be defined in the form of a Steam-ship, a Propeller, or any other Mechanical Appliance? A proposition for the solution of the Scientific World, and for the consideration of the British Admiralty. By ROBERT ARMSTRONG.

London: E. and F. N. SPON, 16 Bucklersbury. (291)

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London: TRUBNER and CO., 60 Paternoster-row. (289

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WATER POISONED BY LEADEN PIPES.

"The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight. The water has cut these deep pits almost through the pipe, and not only upon the portion which we have illustrated, but has formed similar chasms throughout the entire length."—*Expositor.*

Poisoned Water Preventable.

BY THE USE OF GUTTA PERCHA TUBING.

The Gutta Percha Company have been favoured with the following letter,

From Dr. MURRAY, Hull.

"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha. Nothing can be better. I have also recommended it to others, who have adopted the expedient.

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The Gutta Percha Company have been favoured with the following Letters in reference to the non-conducting properties of Gutta Percha Tubing, in the resistance of Frost.

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Every Variety of Gutta Percha Article

SUCH AS

Mill-bands,	Flasks,
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Sheet,	Galvanic Batteries,
Pump-buckets,	Toilet-trays,
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Bottles,	Curtain-rings,
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The MECHANICS' MAGAZINE will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and or 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

THE demand for Mr. E. J. REED's paper—

ON THE MODIFICATIONS WHICH THE SHIPS OF THE ROYAL NAVY HAVE UNDERGONE DURING THE PRESENT CENTURY, IN RESPECT OF DIMENSIONS, FORM, MEANS OF PROPULSION, AND POWER OF ATTACK AND DEFENCE,"

has been so great that the Journal of the Society of Arts, the MECHANICS' MAGAZINE, and all other Scientific Journals in which it appeared in December last, are now out of print. The demand still continuing, it has been deemed desirable to reprint it in a separate form. An 8vo. edition of it, in large type, and on fine paper, has, therefore, been prepared, and may now be had at the Office of this Magazine, price 1s.

PRICES CURRENT OF METALS.

London, 8th July, 1859.

	£ s. d.	£ s. d.	Dis. p. et.
IRON, Rails in Wales and N. of England ..... pr. ton	6 0 0 to	6 5 0	nett
Welsh Bars, in Wales .. „	5 15 0	6 0 0	3
Staf. Bars at the Works „	7 0 0 „	7 10 0	2½
„ Hoops ..... „	8 0 0 „	8 10 0	„
„ Sheets, Singles .. „	8 10 0 „	9 0 0	„
„ Nail Rods ..... „	7 0 0 „	7 10 0	„
„ Boiler Plates .... „	8 10 0 „	9 0 0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow..... „	2 9 6	2 9 3	nett
Do. No. 1, Good Brands „	2 10 0 „	2 12 6	„
Scotch Bars ..... „	7 0 0 „	7 15 0	3
Swedish Bars, in London „	13 10 0 „	15 0 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 11½		3
Tough Cake and Tile „ ton	102 10 0		„
Best Selected..... „	105 10 0		„
Australian ..... „	103 10 0		„
South American			„
Yellow Metal Sheathing..... per lb.	0 0 9½		„
BIREL, Swedish Keg ..... pr. ton	19 0 0 „	19 10 0	2½
„ Faggot ..... „	21 0 0 „	21 10 0	„
TIN, English, Block ..... pr. cwt.	6 5 0		2½
„ Bar..... „	6 6 0		„
Foreign, Banca ..... „	7 0 0		nett
„ Straits..... „	6 16 0		„
TINPLATES, Charcoal, I.C. .. pr. box	1 11 0 „	1 12 0	3
„ Coke, I.C. ..... „	1 5 0 „	1 6 0	„
LEAD, Pig, English ..... pr. ton	22 15 0 „	23 5 0	2½
„ Spanish ..... „	22 0 0 „	22 10 0	„
Sheet ..... „	23 15 0	24 10 0	„
SPELTER, on the spot ..... pr. ton	19 15 0	20 0 0	nett
for arrival..... „	19 15 0 „	20 0 0	„
ZINC, English, Sheet ..... „	26 10 0 „	27 0 0	1½
QUICKSILVER ..... per btl.	7 0 0		1½

REMARKS. — The Metal Market generally quiet. The price of copper was reduced ½d. per lb. on the 1st inst. *Banca*.—The Dutch Company's sale began to-day, and opening prices were about 82½, or 140s. per cwt.

LAWRIE AND HAGGER, Metal Brokers.
33 Lombard-street, E.C.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

CHURCH WORKS, *Knowle, Warwickshire*.—Erection of vestry and reseating parish church. Plans, &c., at the vestry. A day fixed on application to Mr. J. Nevill, architect, Coventry, from whom further information. Tenders to the Churchwarden before noon, July 25.

STONE, *Hargate*.—For the supply of 80 to 100 tons of the best blue Guernsey granite broken to a two-inch ring, sifted free from small and dust, and delivered over the ship's side in the harbour before the end of October next Tenders to the town clerk before July 18.

DESIGNS FOR CEMETERY, *Barnsley*.—Two chapels and entrance lodge. Area, 13 acres. Expense of erections and laying-out not to exceed £4,000. £30 for the best, and £10 for the next best designs. Tenders to the Board, July 23.

CHURCH, *Medsted*.—For additions. Plans at the Parsonage. No date given.

ABLUTION ROOM, &c., *Great Yarmouth*.—With washhouse, &c., at the temporary barracks. Drawings and forms of tender at the engineer's office, Great Yarmouth, up to Wednesday, July 13. Tenders, July 16, to the directors of contracts, War Office, Pall-Mall.

ENLARGEMENT AND RESTORATION, *Morton Pinkey, Northamptonshire*.—To the Manor House, plans, &c., Mr. E. F. Law, architect, Northampton. Tenders, July 16.

SIX LABOURERS' COTTAGES, *Heron*.—Parish of Coryton, near Tavistock, to contain kitchen, office, and three bedrooms. Particulars and plans, Mr. Michelmore, Manor Cottage. Tenders, July 13.

COALS, *Bridewell and Bethelem Hospitals*.—680 tons of Lambton or Hettons Wall, and 200 tons of Llangennick Welsh coals, to be delivered before the 30th September. Tenders to clerk's office, Bridewell Hospital, New Bridge-street, Blackfriars, July 9.

STONE, *Warrington*.—1,500 tons of broken stone for the repairs of streets. To pass through a two-inch ring, and delivered at the Bank Quay. Further particulars of the Bow engineer, to whom tenders and samples, July 16.

GRANITE, *Truro*.—For pavements. To be from 3 feet to 6 feet long, and 6 inches thick, at per foot super. For kerbs, 1 foot square, at per foot run. For gutters, 1 foot 4 inches wide, pink 10 inches wide 8 inches deep, at per foot run. Tenders, July 18.

SCHOOLROOMS and RESIDENCES, *Bloxwich*.—Three schoolrooms and two residences, at Bloxwich, near Walsall. Plans and all necessary information Mr. J. Cranston, architect, 2 Bennett's Hill, Birmingham. Tenders to Charles Somerville, Esq., Bloxwich, July 21.

FURNISHING THE WESTMINSTER PALACE HOTEL.—In all its departments. Forms of specification and tender, the secretary, 5 Parliament Street. Tenders July 18. Seventy-five per cent. to be paid in cash on delivery and approval, the rest on completion of the work.

HEAD-FOREMAN. — Marine-engine manufactory, to take charge of all except foundry and boiler and smiths' shops. Apply by letter to "P., Gateshead."

PURSER, *Great Eastern*. — Applications for the appointment of purser to the steam-ship Great Eastern, to be sent to the company. Temporary offices, 79 Lombard-street, July 16.

FOREMAN.—Not more than 40 years of age, having already filled the position of foreman of smiths and fitters. One accustomed to the manufacture of iron roofs and bridges, preferred. Address, K., 26 *Journal* office, Birmingham.

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The keeping a Registry of all Patents taken out by the Company, and the furnishing a Monthly List thereof to all Subscribers.
All information may be obtained at the Office, and the Deposit may be remitted to the Bankers or to the Secretary. (223)

MR. WALTER HALL is prepared to Grant Licences, or to Dispose of his Patent for working Railway Breaks. Particulars to be had of Mr. HALL, who may be addressed by letter to the care of the MECHANICS' MAGAZINE, 166 Fleet-street, E.C. (217)

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4th. They require only a very small quantity of oil.
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WALLIS & HASLAM,
Engineers and Iron Founders, North Hants Iron Works, Basingstoke. (121)

LIST OF PRIZE SUBJECTS FOR SESSION 1859-60.

THE ROYAL SCOTTISH SOCIETY OF ARTS proposes to award PRIZES of different values, of THIRTY SOVEREIGNS and under, in GOLD or SILVER MEDALS, SILVER PLATE, or MONEY, for approved Communications *primarily* submitted to the Society, relative to INVENTIONS, DISCOVERIES, and IMPROVEMENTS in the *Mechanical* and *Chemical* Arts in general, and in their relation to the Fine Arts, and also to means by which the *Natural Productions* of the Country may be made more available. The Society suggests the following as a few of the many subjects that may be attended to, viz. :—

I. INVENTIONS, DISCOVERIES, or IMPROVEMENTS in the Useful Arts.

1. *Mechanical Arts.*

Inventions or Improvements in applying the Motive Power of Men and Animals,—in Wind and Water Prime Movers,—in Steam and other heat Engines and their various applications,—in Pumping, Blowing, Rolling, Sawing, Agricultural, and other Engines and Machines, —in Cotton and other Textile Manufacturing Mills, —in Shipbuilding, Wood, Iron, and Steel,—in Lighthouses,—in Marine Propellers,—in Railways, Plant, and Signals —in Electro-Magnetic Motive Power,—in Electric and other Telegraphic Apparatus, Submarine and Aerial,— in Photographic Apparatus,—in Fire-Proof Buildings,— in Water Supply,—in Paving,—Sewerage,—in Economical Appliances for increasing the Sanitary Condition of Towns,—in Smoke Consumption and Extinguishing Fires,—in Gas Works,—in Canals and Inland Navigation, —in Tools, Implements, and Apparatus for the various Trades,—in Bricks, Encaustic Tiles, Cements, and Mortars,—in Printing Machines, Cases, and Rollers,—in Stereotyping,—in Cranes,—in the Machinery for Collieries,—in preserving Timber and Metals in Marine Works,—in Optical Apparatus for Astronomy, Surveying, and Levelling,—in Manufacture of Paper, &c.

2. *Chemical Arts.*

INVENTIONS or IMPROVEMENTS in New and Useful Applications of Gutta Percha and Vulcanised India Rubber, or similar Gums,—in the Economical Extraction of Chemical Principles or Useful Substances, as Paraffine, &c., from Coal, Porcelain, Clay from Granite or Feltspar, and Metals generally from their Ores and Oxides,—in Dyes, in Paints,—in Paper,—in Glass, especially for Lenses, — in methods of rendering the Electric Light available in practice; &c.

3. *Relative to the Fine Arts.*

INVENTIONS or IMPROVEMENTS in Photographic Processes, in "Carbon" Printing, and in Methods of Printing Photographs from their Impressions on Steel or Copper Plates, or Lithographic Stones,—in Electrotype Processes,—in Die-sinking, — in Methods of Illustrating Books, to be Printed with the Letterpress,—in Paper-Hangings,—in Articles of Porcelain, Common Clay, or Metal,—in Glass-Staining, in Engraving on Stone,—in Chromo-Lithography,—in "Nature" Printing.

4. *Natural Productions.*

Discovery of Plumbago Mines,—of Slate Pencil of good quality,—Whet-stones,—of Wood suitable for Engraving.

II. EXPERIMENTS applicable to the Useful Arts.

III. COMMUNICATIONS of Processes in the Useful Arts practised in this or other Countries, but not generally known.

IV. PRACTICAL DETAILS of Public or other Undertakings of National importance, already executed, but not previously published; or valuable Suggestions for originating such undertakings.

KEITH PRIZE, value Thirty Sovereigns.

For some important "Invention, Improvement, or Discovery, in the Useful Arts, which shall be primarily submitted to the Society" during the Session.

MAKDOUGAL BRISBANE BIENNIAL PRIZE, Value £10.

"To the Authors or Inventors of Communications of Merit, which shall be approved of by the Society, or its Committee, and judged by them deserving of such distinction."

REID AND AULD PRIZES.

For the First, Second, and Third best Models of "anything new in the Art of Clock or Watch Making, by Journeymen or Master Watch and Clock Makers," if these should be considered worthy of Prizes, the year's Interest of the Reid and Auld Bequest, being about SEVEN GUINEAS, divided among them in such proportions as the Prize Committee shall fix, according to merit. To such as deserve it, the Society may add to the amount of the Prize out of its general funds.

GENERAL OBSERVATIONS.

Communications lodged *in competition for Prizes* shall not have been patented, nor previously published, nor read before any other Society, but Patented Articles may be exhibited and described. The descriptions of the various inventions, &c., must be *full* and *distinct*; and be written on *Foolscap* paper, with binding margins. The relative Drawings to be on *Imperial* Drawing-paper, and in *bold* lines, or *strongly coloured*, so as to be easily seen at about the distance of thirty feet when hung up in the Hall. The Society shall be at liberty to publish in their Transactions the papers submitted to them, or abstracts thereof. Models, &c., for which Prizes are given, to be held the property of the Society; the Value of the Models, &c., being separately allowed for.

Communications to be sent free to the SECRETARY, Chambers, 5 Hill Street, Edinburgh, on *or before* 1st *November*, 1859, in order to ensure their being read and reported on during the Session, the ordinary Meetings of which commence in November 1859, and end in April 1860; but *those which cannot be lodged earlier* will be received up to 1st April, 1860, although they may possibly not be read or reported on till the following Session.

By order,
JOHN BEATSON BELL, Secretary.
Edinburgh, June, 1859. (287)

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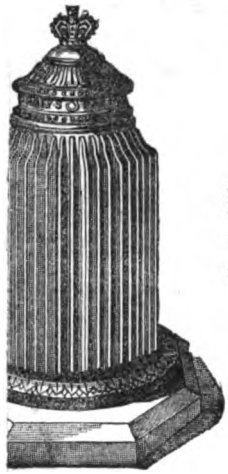

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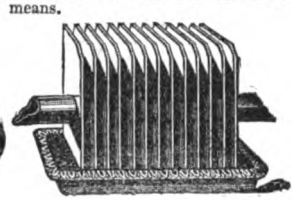

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The apparatus may be seen in ST. PAUL'S CATHEDRAL, the various offices of the "Department of Science and Art," and in many churches and other buildings.

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(12)

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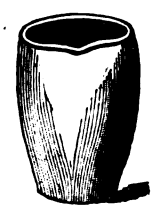

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VIZ.:

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LONDON, March 25, 1859.

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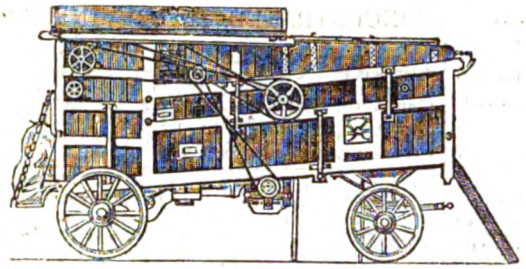

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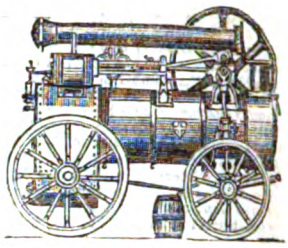

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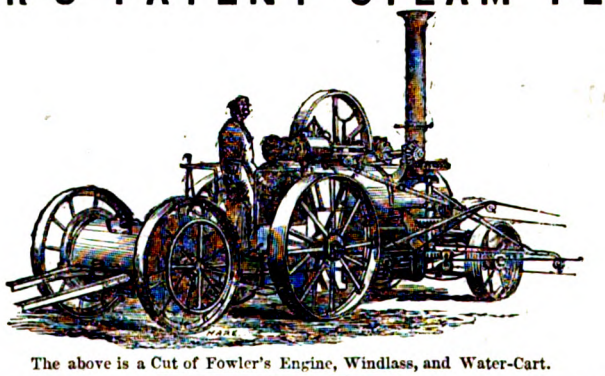

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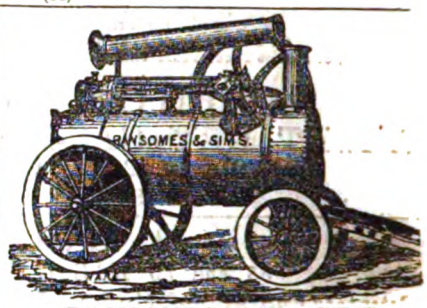

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 29.
[NEW SERIES.]

LONDON: FRIDAY EVENING, JULY 15, 1859.

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The St. GEORGE'S CHOIR every Wednesday Evening, at Eight. (310)

METROPOLITAN BOARD of WORKS.—MAIN DRAINAGE of the METROPOLIS.—SOUTHERN HIGH LEVEL SEWER.—To BUILDERS, CONTRACTORS, and Others.—The Metropolitan Board of Works hereby give notice, that they will MEET at the Council Chamber, Guildhall, in the City of London, on Friday, the 22nd day of July inst., at Twelve o'clock at noon precisely, and will then be prepared to open TENDERS by parties who may be willing to CONTRACT for the CONSTRUCTION of MAIN BRICK SEWERS, Nine Miles 2,940 Feet in length, or thereabouts, and for the execution of other works in connection therewith, to extend from Deptford Creek to High-street, Clapham. Also, a Branch to extend from the Broadway, Deptford, to the point of junction with the Effra Sewer, in Croxted-lane, Dulwich; and for the maintenance of such works in complete repair for twelve calendar months.

Parties desiring to submit Tenders may, upon payment of £3, obtain plans, sections, specification, form of tender, and other particulars, on application at the Office of the Board, between the hours of Nine a.m. and Four p.m.

Tenders addressed to the Metropolitan Board of Works, must be delivered at the Office of the Board, No. 1 Greek-street, Soho, between Four o'clock p.m., on Thursday, the 21st day of July inst., and no Tender will be received after that hour.

The Board do not bind themselves to accept the lowest or any Tender, and the party whose Tender shall be accepted will be required to provide two approved sureties for the due performance of the works.

E. H. WOOLRYCH, Clerk of the Board.
No. 1 Greek-street, Soho, July 2, 1859. (311)

COTTON SUPPLY ASSOCIATION.
TRIAL OF COTTON GINS.

IMPROVEMENT upon the INDIAN CHURKA.—All persons intending to submit gins for competition at the above trial, must forward them to the offices of this Association on or before the 19th day of July next, after which day no gin will be received.

The trial will take place on Tuesday, the 26th day of July. Further particulars may be obtained by application at the offices of the Cotton Supply Association.

G. R. HAYWOOD, Secretary.
1 Newall's Buildings, Manchester. (300)

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"This appeared to the Committee of vast importance to the Shipping Interests, &c."

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THE ANCHOR COMMITTEE

Nominated by the Lords Commissioners of the Admiralty "to investigate and determine the relative merits of Anchors," in compliance with a requisition from the principal Shipowners, Underwriters, &c., of the United Kingdom.

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Capt. Superintendent Charles Hope, R.N., Her Majesty's Dockyard, Sheerness.

Captain George Rodney Munday, R.N., Her Majesty's Ship "Nile."

Jonathan Aylen, Esq., R.N., Master Attendant, Her Majesty's Dockyard, Sheerness.

James Tonkin, Esq., Master, R.N., Her Majesty's Ship "Waterloo," 120 guns.

William Schaw Lindsay, Esq., M.P., &c., &c.

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Anthony Ridley, Esq., Vice-Chairman of Mercantile Marine Board; Member of the Committee of "Lloyd's Register" of Shipping, &c.

William Drew, Esq., Member of the Mercantile Marine Board; Member of the Committee of "Lloyd's Register" of Shipping, &c.

William Phillips, Esq., Member of the Committee of "Lloyd's Register" of Shipping; General Shipowners' Society, &c.

George Marshall, Esq., Member of the Committee of "Lloyd's Register" of Shipping; General Shipowners' Society, &c.

THE INTERNATIONAL JURY AT PARIS
Also awarded this Invention the First Class Medal, 1855.

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" Proctor and Taylor, Milbank Forge, Hartlepool,
" Henry Wood and Co., Goree Piazzas, Liverpool,
" Wood Brothers, Chester, Wolverhampton, and Stourbridge,
" R. Wight and Sons, Iron Works, Sunderland and Seaham,
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PATENTEE, 42 CORNHILL, LONDON.
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July, 1859. (309)

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TO RAILWAY COMPANIES, CONTRACTORS, AND OTHERS.

GEORGE NEIGHBOUR and SONS, OIL MERCHANTS,
Particularly invite attention to their PATENT ARGAND LAMP OIL, for Railway Roof and Signal Lamps; also to their EXTRA-REFINED ENGINE OIL, for Locomotive and Machine purposes. Prices forwarded on application.
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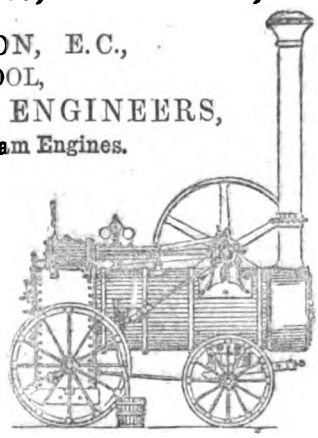

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PATENT GRASS SEED SEPARATOR,

which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

PERENNIAL AND ITALIAN RYE-GRASS, &c.,

AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

These Machines were admittedly the most novel, and, at the same time, the most useful and important to the Farmer of any exhibited at the late SMITHFIELD CLUB SHOW.

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18th May, 1859. (264)

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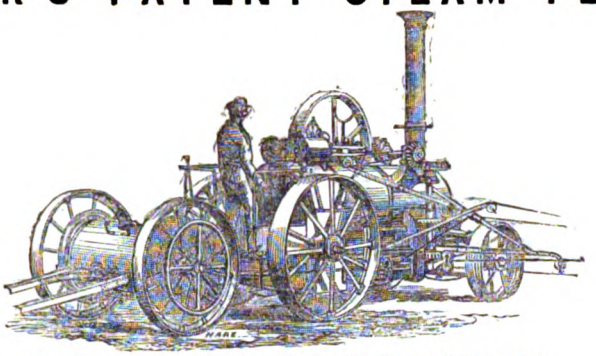

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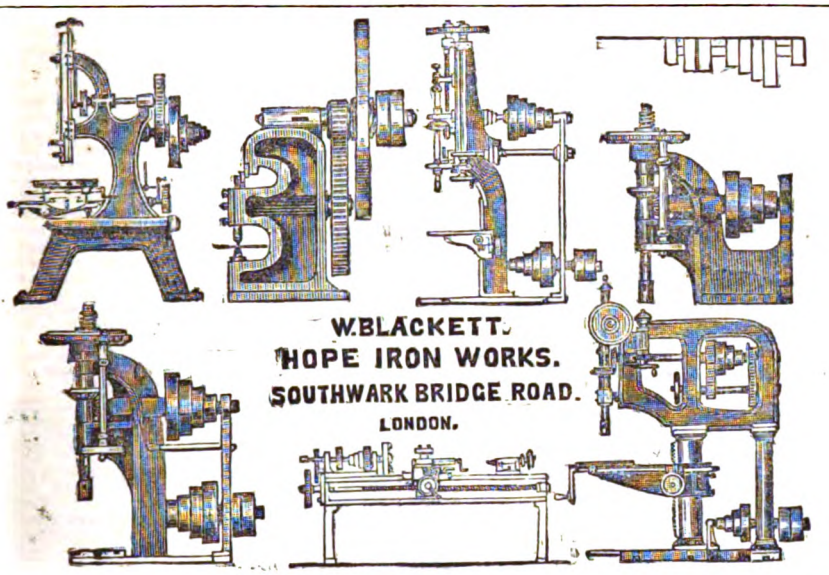

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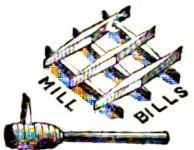

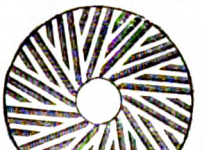

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Two of 12-horse power, 12in. cylinder, and 24in. stroke.
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LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

CHURCH WORK, *Ireland*.—For rebuilding the church of Killany, County Monaghan; for enlarging the churches of Knocknamuckly, County Down; Donahendry (Stewartstown) and Drumnakilly, County Tyrone; for fitting-up, &c., externally, the churches of St. Anne, County Dublin; Ballymoney, County Antrim; and Leixlip, County Dublin. For repairing the churches of Swift's Alley, City of Dublin; Clouleigh (Lifford), County Donegal; Cooltrain, County Fermanagh; and Cahir (Rathronan), County Tipperary. For repairing and painting externally the churches of Derrykeighan, County Antrim; Killilea, County Armagh; Urney (Cavan), County Cavan; and Trory, County Fermanagh; and for painting internally the churches of St. Mark, City of Dublin; and Cahir, County Tipperary.—Plans and specifications to be seen at the resident ministers of the parishes. Tenders to be addressed, "Proposal for.....the church of.....

"The Ecclesiastical Commissioners for Ireland,
"No. 24 Upper Merrion-street, Dublin."

BARRACK WORKS, *Ireland*.—For constructing water-closets to A R K O and Q houses; and water-closets, servants' kitchens, to N and P houses, at Cahir barracks, in the Limerick district. Drawings, &c., Commanding Royal Engineer's Office, Lower Castle-yard, Dublin; or at the Royal Engineers' offices at Limerick and at Cahir barracks. Tenders to the Director of Contracts, War-Office, London, S. W., July 28.

CATHEDRAL WORK, *Ireland*.—For the roofing, slating, ceiling, glazing, and other works to be done in the new cathedral of St. Patrick's, Armagh, according to plans and specifications at the college adjoining. J. J. M'Carthy, architect. Tenders to Henry Savage, Esq., Armagh, August 11.

ROADS, *Rusholme*.—For the repair and watering of the roads of the local borough for five years, and for the supply of the stone. Tenders, August 1, Mr. J. Law, 53 Piccadilly, Manchester.

PLANS, &c., FOR BATHS AND WASH-HOUSES, *Altrincham*.—Particulars, Messrs. Nicholls and Worthington, Solicitors, Altrincham.

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POWDER MAGAZINE, *Pembroke Dock*.—And other buildings connected. Plans, &c., the Royal Engineer-office, Pembroke Dock, and copy of the form of tender, with terms of contract of E. T. Ford, Lieut.-Col. and Col.-Com. Royal Engineers, South Wales District. Tenders, July 25, to the Director of Contracts, War Department, Pall Mall.

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NEW CHURCH, *Winchester*.—Plans, &c., except on July 18, Mr. Christian, 10 Whitehall-place, London. Tenders, to 10 a.m., July 29.

CHURCH TOWER, *Kent*.—For completing the tower of Leigh church, near Tonbridge. Plans, &c., Mr. Charles Bailey, 72 Gracechurch-street, London. Tenders to 1 o'clock, July 27.

CHURCH OF ENGLAND INSTITUTE, *Sheffield*.—Plans, &c., Messrs. Flockton and Son, architects, East-parade, Sheffield. Tenders, July 18.

WORKHOUSE, *Sheffield*.—Enlargement and alteration. Plans, &c., Mr. Cushin, architect, 16 Bank-street, Sheffield. Tenders, July 20.

CHELSEA VESTRY HALL.—Drawings, &c., at the office of the architect, Mr. W. W. Pocock, 10 Trevor-terrace, Knightsbridge. Further particulars to be announced.

HOUSE OR VILLA, *Penkridge*.—Plans, &c., Littleton Arms, Penkridge, Staffordshire. Tenders, July 25.

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COALS, *Hanwell Lunatic Asylum*.—About 350 tons of Lambton's and 850 tons of Merthyr, during a twelvemonth from July 21 inst., at which date, by noon, tenders must be sent to the Asylum, where blank forms may be had, or of Mr. Wright, clerk to the visitors, 6 Johnstreet, Bedford-row.

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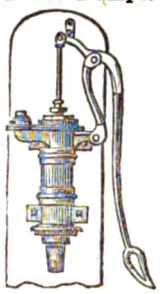

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3 ,,	6 ,, 6 ,,	2	8
3½ ,,	6 ,, 6 ,,	3	3
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2½ in. short, with 15 feet of Lead Pipe attached, ready for fixing		2	14
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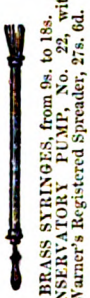

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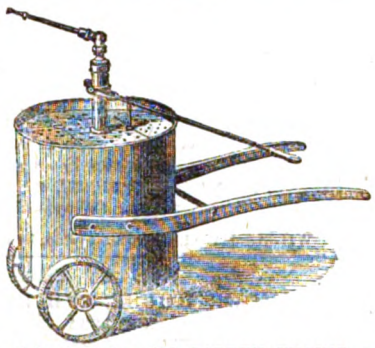

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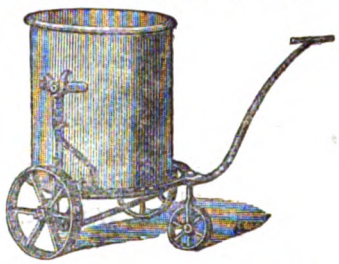

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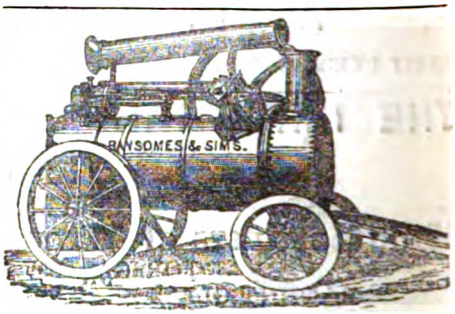

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 30.
[New Series.]

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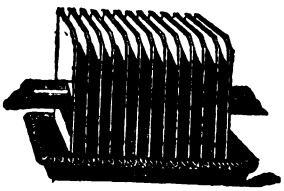

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The WINDING TACKLE can be fitted to Engines of any maker, and the Plough can be made to take any kind of apparatus necessary for Cultivating the Soil, such as Scarrifier Tines or Broad Shares, &c. Any Engine now used by farmers can be fitted with the Tackle. It is light and simple, and an ordinary Farm Labourer can work it.

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which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

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AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

These Machines were admittedly the most novel, and, at the same time, the most useful and important to the Farmer of any exhibited at the late SMITHFIELD CLUB SHOW.

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Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.

This fluid has been examined and reported upon by the Board of Health, all the most eminent Men and Chemists of the day, in all cases in the most satisfactory manner possible.

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RICHARD BAIRD, GENERAL COMMISSION AGENT, and CONTRACTOR for all descriptions of RAILWAY PLANT and STORES.

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18th May, 1859. (264)

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By Royal Letters Patent.

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SHIP-OWNERS, SHIP-BUILDERS, AND COMMANDERS OF STEAM AND SAILING VESSELS,

to the Simple and Efficient Arrangements of their

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Both Fixed and Portable, with PATENT VALVES and other Improvements.

These Pumps are free from that liability to choke which is common to other Pumps, and their Working Parts are not susceptible of derangement either from wear or from being long out of use. They pass entirely through them, with ease, any substance that may enter the Suction Pipes. The Novelties in these Pumps are their adaptation to the varied duties of Ships' Pumps, the facilities they afford for Cleansing the Suction Pipes, and for Sounding or Examining the Valves; the readiness with which they may be used for Ventilating the Bilge, or for acting as a Syphon either for Watering the Ship, or for extinguishing Accidental Fires on board: the rapidity with which they can be converted into Fire Pumps, or be applied to the Washing of Decks; and their capability of Pumping from Several Compartments. Also, to their

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Suitable for testing the speed of all classes of machinery.

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With Coolers and Dippers for same. Injection Tallow-Cocks, and various kinds of Syringes.

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Which will be found both Simple and Efficient for the Distillation of Fresh from Salt Water.

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Cambridge: DEIGHTON, BELL, and Co. London: BELL and DALDY. (310)

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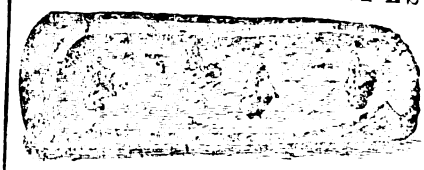
WATER POISONED BY LEADEN PIPES.



"The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight. The water has cut these deep pits almost through the pipe, and not only upon the portion which we have illustrated, but has formed similar chasms throughout the entire length."—*Expositor.*

Poisoned Water Preventable.

BY THE USE OF GUTTA PERCHA TUBING.

The Gutta Percha Company have been favoured with the following letter,

From Dr. MURRAY, Hull.

"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha. Nothing can be better. I have also recommended it to others, who have adopted the expedient.

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The Gutta Percha Company have been favoured with the following Letters in reference to the non-conducting properties of Gutta Percha Tubing, in the resistance of Frost.

From J. ARMSTRONG, Esq., M.D., Gravesend.

"My private house, which was supplied with your Gutta Percha Tubing some five or six years ago, has never required the slightest attention; and previously, there was no winter passed that we were not deluged in consequence of the bursting of the leaden pipes."

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"We have now a positive proof of the frost-resisting properties of the Gutta Percha Piping. On our premises we have a leaden Pipe and a Gutta Percha one lying side by side. The leaden one has been completely frozen up at least ten days, and the Gutta Percha one is still unaffected.

Every Variety of Gutta Percha Article

SUCH AS

Mill-bands,
Tubing for Watering Gardens, &c., &c.,
Soles,
Sheet,
Pump-buckets,
Fire-buckets,
Bottles,
Bosses,
Union-joints,
Flasks,
Bowls,
Chamber-vessels,
Galvanic Batteries,
Toilet-trays,
Sponge-bags,
Curtain-rings,
Talbotype-trays,
Photographic Baths.
&c., &c.

MANUFACTURED BY THE

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(54)

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All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements.

To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

The demand for Mr. E. J. REED's paper—

ON THE MODIFICATIONS WHICH THE SHIPS OF THE ROYAL NAVY HAVE UNDERGONE DURING THE PRESENT CENTURY, IN RESPECT OF DIMENSIONS, FORM, MEANS OF PROPULSION, AND POWER OF ATTACK AND DEFENCE,"

has been so great that the Journal of the Society of Arts, the MECHANICS' MAGAZINE, and all other Scientific Journals in which it appeared in December last, are now out of print. The demand still continuing, it has been deemed desirable to reprint it in a separate form. An 8vo. edition of it, in large type, and on fine paper, has, therefore, been prepared, and may now be had at the Office of this Magazine, price 1s.

PRICES CURRENT OF METALS.

London, 22nd July, 1859.

	£ s. d.	£ s. d.	Dis. p. ct
IRON, Rails in Wales and N. of England ..... pr. ton	6 0 0 to		nett
Welsh Bars, in Wales .. "	5 15 0 "	6 0 0	3
Staf. Bars at the Works "	7 0 0 "	7 10 0	2½
" Hoops ..... "	8 0 0 "	8 10 0	"
" Sheets, Singles .. "	8 10 0 "	9 0 0	"
" Nail Rods ..... "	7 0 0 "	7 10 0	"
" Boiler Plates .... "	8 10 0 "	9 0 0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow..... "	2 12 0 "	2 12 3	nett
Do. No. 1, Good Brands "	2 12 0 "	2 15 0	"
Scotch Bars ..... "	7 0 0 "	7 15 0	3
Swedish Bars, in London "	13 10 0 "	15 0 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 12		3
Tough Cake and Tile .. ton	107 10 0		"
Best Selected..... "	110 10 0		"
Australian ..... "	113 0 0		"
South American .... "	103 0 0 "	104 0 0	"
Yellow Metal Sheathing..... per lb.	0 0 10		"
STEEL, Swedish Keg ..... pr. ton	18 15 0 "	19 0 0	2½
" Faggot ..... "	20 15 0 "	21 0 0	"
TIN, English, Block ..... pr. cwt.	6 18 0		2½
" Bar..... "	6 19 0		nett
Foreign, Banca ..... "	7 6 0		"
" Straits..... "	7 0 0	7 3 0	3
TINPLATES, Charcoal, I.C. .. pr. box	1 13 0 "	1 14 0	"
" Coke, I.C. ..... "	1 7 0 "	1 9 0	"
LEAD, Pig, English ..... pr. ton	22 15 0 "	23 5 0	2½
" Spanish ..... "	22 0 0 "	22 10 0	"
" Sheet ..... "	23 15 0 "	24 10 0	"
SPELTER, on the spot ..... pr. ton	21 0 0 "	21 2 6	nett
" for arrival..... "	21 0 0		"
ZINC, English, Sheet ..... per bdl.	25 10 0 "	26 0 0	1½
QUICKSILVER ..... per bdl.	7 0 0		1½

REMARKS.—Our Metal Market is this week quiet, with a slight reaction in some articles from the prices of last week. The most material fall is in Scotch Pig-iron, which has declined to 52s. 3d. for Mixed Numbers Warrants.

LAWRIE AND HAGGER, Metal Brokers.

33 Lombard-street, E.C.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

RAILWAY WORKS, *India*.—For the completion of the Bhore Ghaut Incline of the Great Indian Peninsula Railway (Contract No. 7), situated 60 miles from Bombay, at the end of the portion of the South Eastern line in the Concan, which is open for public traffic. Plans, &c., with engineer's estimate, 3 New Broad-street, London. Tenders, one o'clock July 29.

RECTORY, *Llanfynydd, Denbighshire*.—Plans, &c., Rev. R. Lloyd, Cifynbedd, near Wrexham, Tenders to the architect, Mr. Christian, 10 Whitehall-place, London, July 28.

RAILWAY, *Border Union (North British)*.—For the whole works on the Main Line, the Gretna Branch, and a portion of the Langholm Branch, in separate Contracts as under:—1. The Hawick Contract, commencing at the Hawick Station of the North British Railway, and terminating near Shankend, in length about six miles and four furlongs.—2. The Whitrope contract, commencing near Shankend and terminating near Staychill Hill, in length about four miles and five furlongs. The above includes a tunnel 1,160 yards in length.—3. The Riccarton Contract, commencing near Staychill Hill, and terminating at Caldell Syke, near Riccarton, in length about three miles and three furlongs.—4. The Hermitage Contract, commencing at Caldell Syke and terminating at New Castleton, in length about six miles and six furlongs.—5. The New Castleton Contract, commencing at New Castleton and terminating where the line crosses Kershop Water, in length about three miles.—6. The Penton Contract, commencing at the point where the line crosses the Kershop Water and terminating near the Riddings Farm-house, in length about six miles and six furlongs.—7. The Netherby Contract, commencing near the Riddings Farm-house and terminating on the main line near Longtown, in length about four miles and five furlongs; and the Canobie Coal Pits Branch, in length about three furlongs. The total length of the contract being about seven miles and one furlong.—8. The Carlisle Contract, commencing near Longtown and terminating by a junction with the Port Carlisle Railway, near Carlisle, in length about eight miles and four furlongs.—9. The Gretna Branch Contract, commencing at a point on the main line near Longtown, and terminating by a junction with the Caledonian Railway at the Gretna Station on that line, in length about three miles and one furlong.—The rails, chairs, &c., will be supplied by the Railway Company. Tenders must be given for each contract separately. The plans, sections, specifications, and draft contract-deeds may be seen at the North British Railway office, Canal-street, Edinburgh, or at the offices of the engineers, Mr. Chas. Jopp, 118 George-street, Edinburgh, and Mr. John E. Tone, 21 Market-street, Newcastle-upon-Tyne, from whom schedules of measurements and forms of tender may be obtained. Copies of the parliamentary plans may be seen at the offices of John Hawkshaw, Esq., C.E., Great George-street, Westminster. Tenders at the offices, Canal-street, Edinburgh, noon, August 17, when contractors or their agents must attend.

RAILWAY, *Findhorn, Scotland*.—For the construction of the whole works, including supply of rails, chairs, sleepers, &c. Plans, &c., Messrs. Bruce and Cunningham, C.E., 21 Castle-street, Edinburgh. Tenders, John D. Davidson, writer, Forres, August 4.

RAILWAY STATIONS, *North Eastern*.—For the conversion of the old passenger-station at Durham into a goods-station. Plans, &c., Mr. Prosser, Central Station, Newcastle-on-Tyne. Tenders, August 3; when also tenders for a station and dwelling-house at the Tyne Dock Station, near South Shields; and for the erection of workshops with iron roof, and other buildings at Tyne Dock. Three contracts.

LANDING PLACE, *Portsea*.—For reconstructing the hard and landing-place at the Anchor-gate. Drawings, &c., and information, Messrs. Haughton and Son, civil engineers, Union-passage, Portsea. Tenders, July 25.

LONDON MAIN DRAINAGE, *Acton Branch*.—For main brick and iron sewers, 7,350 ft. in length, with other works in connection therewith, in the Uxbridge-road and at Kensington and Hammersmith. Plans, &c., to the 28th inst. at the office of the Metropolitan Board of Works, 1 Greek-street, Soho.

BREAKWATER, *Granton Harbour, near Edinburgh*.—Contractors are wanted for the prolongation of the Eastern Stone Breakwater, about 700 yards. Plans, &c., Mr. J. Howkins, engineer, Granton Harbour. Tenders to Messrs. Gibson, W.S., 12 Charlotte-street, Edinburgh, Aug. 13.

WATER-WORKS, *Merthyr Tydfil.—Extension of Time*.—Engine and boiler-house, depositing-tanks, filter beds, two covered service reservoirs, two cottages, and other works connected. Specifications, &c., Mr. Hawksley, C.E., 30 Great George-street, Westminster. Tenders to J. W. Russell, Clerk to Local Board, Merthyr Tydfil, July 27.

SEWERAGE, *Gateshead*.—In the western part of the Borough, comprising the excavation of the ground, the laying of the sewer pipes, the providing and setting street gullies, grates, sewer bottoms, and all other necessary works (except sewer pipes and junction blocks, which are included in a separate tender). Particulars, Town Surveyor. Tenders, August 4.

DRAINAGE PIPES AND JUNCTION BLOCKS, *Gateshead*.—Particulars, Town Surveyor. Tenders, August 4.

CHURCH, *Notts*.—Restoring and refitting East Markham Church, near Tuxford. Drawings, &c., Rev. G. H. Bramwell, Vicarage, East Markham; to whom tenders August 1. Further information, Mr. G. G. Scott, 20 Spring-gardens, London.

UNITARIAN CHAPEL, *Aberdare*.—Plans, &c., Mr. W. G. Paull, 3 St. Mary-street, Cardiff, on and after July 25. Tenders noon, August 2.

SCHOOL, *Salisbury*.—For building St. Edmund's School and School Residence. Tenders, August 1. Plans, &c., to July 23, St. Edmund's Vestry Room.

REBUILDING AND REPAIRING DYKES, &c., *Crown Lands, Stirling*.—Plans, &c., H. M.'s Works, Edinburgh; or with Mr. Dewar, farmer, King's-park, Stirling. Tenders, July 26.

ROADS, *Hanley Cemetery*.—For making terrace roads, paths, surface-draining, cesspools, and laying out and levelling the new public cemetery at Hanley. Plans and specifications at the Borough Surveyor's office, Hanley, the 26th inst. Tenders, Town Clerk, August 3. Bills of quantities on the 26th, the architects, Messrs. Bellamy and Hardy, 30 Broadgate, Lincoln, for 5s. 6d.

ROADS, *Rusholme*.—For the repair and watering, and supply of stone for five years. Tenders, John Hall, law-clerk to the Board, 53 Piccadilly, Manchester.

COAL, *Bilston Gas Company*.—4,000 tons. In quantities. The whole by April 1, 1860. Tenders July 28, Gas-works, Moxley, near Wednesbury, Staffordshire.

SOUTH WALES COALS, *Navy*.—3,000 tons to be delivered at Ascension; 2,000 tons at St. Paul de Loando; and 5,000 tons at the Cape of Good Hope. Conditions, &c., Storekeeper General, Somerset-place. Tenders, two o'clock, July 26.

SLEEPERS, *Edinburgh, Perth, and Dundee Railway*.—For the supply of from 8,000 to 12,000 sleepers of Scotch fir, each not less than 9 ft. × 10" × 5" or 8" × 5". To be of a superior quality, and delivered at the Creosoting Works at Perth or Leith within six months after acceptance. Tenders with Secretary, August 1.

MINERAL BLACK FOR PAINT.—For H.M.s' Dockyard, Chatham. Sample, &c., of the Navy Storekeeper General, Somerset-place. Tenders, Aug. 2, at two o'clock.

SURVEYOR, *Dorchester*.—To devote himself to the carrying out of the private improvements for the drainage and water supply of the borough, under the Public Health Act, 1848. Applications, stating qualifications and salary required, at the Town Clerk's office, August 1.

FOREMAN BOILERMAKER.—Address, stating age, experience, where last employed, and salary expected, "A. B.," Post-office, Ashton-under-Lyne.

GAS-WORKS MANAGER, *Callander, Scotland*.—Working Manager, and to take entire charge of the works. Applicants to state salary in own writing to Walter Buchanan, writer, Callander, July 27.

PAPER MILL MANAGER, *Scotland*.—Where newspaper and printing sorts will be made. Good salary. No. 607 *North British Advertiser* office, Edinburgh.

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RAILWAY CLERK, *India*.—Great Indian Peninsula. Competent to take charge under the Accountant of the Audit Office, Bombay. Salary £360 per annum. Applications to Secretary, 3 New Broad-street, July 27.

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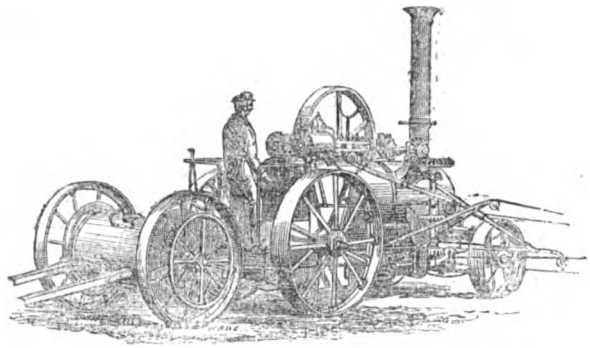

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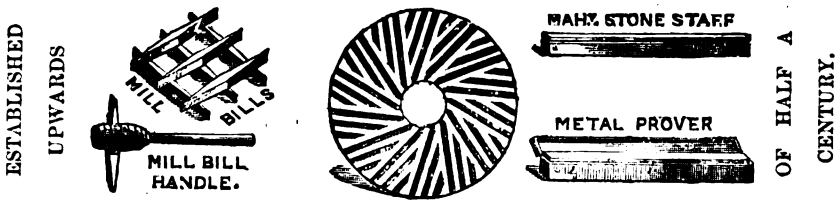

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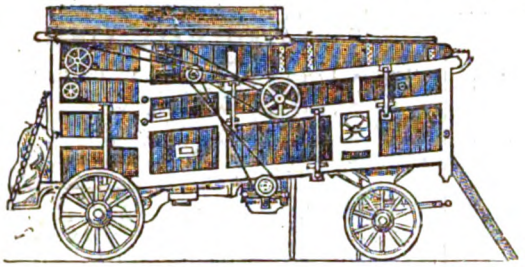

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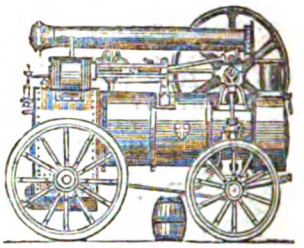

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(BOYDELL'S PATENT,)

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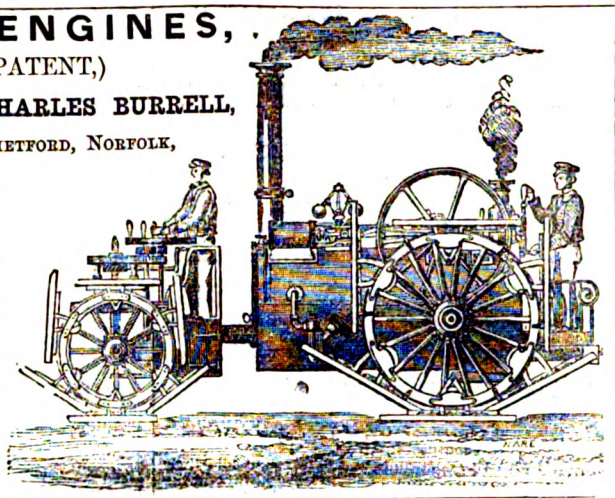

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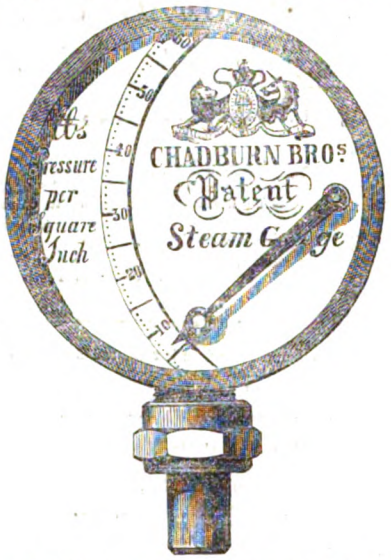

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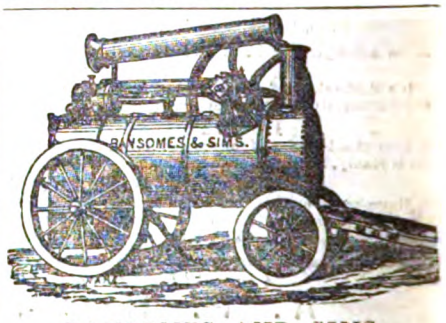

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 31.
[NEW SERIES.]

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BY POST 5d.

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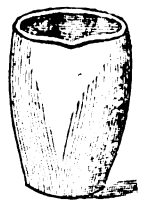

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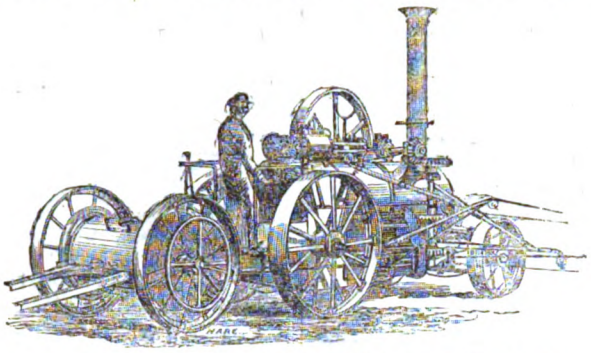

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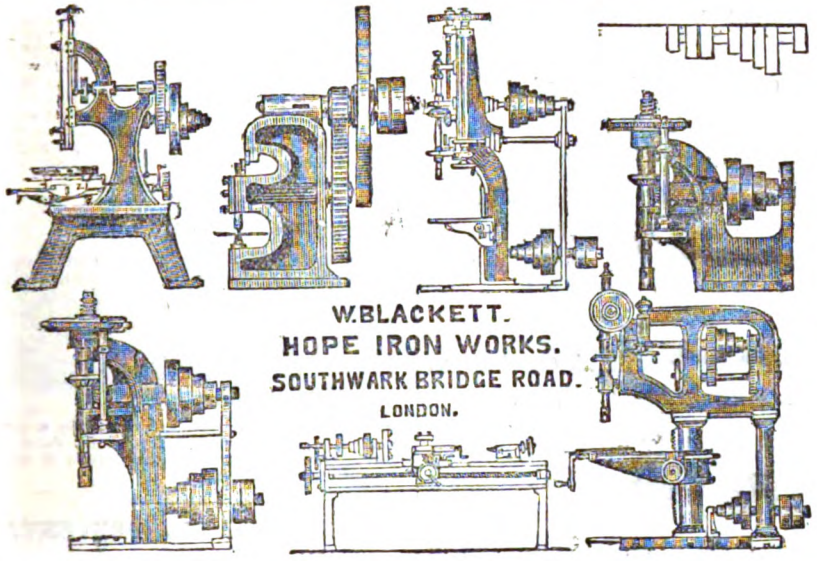

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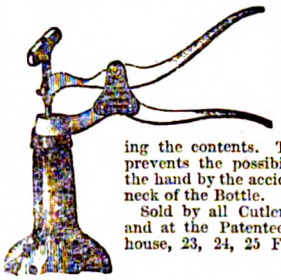

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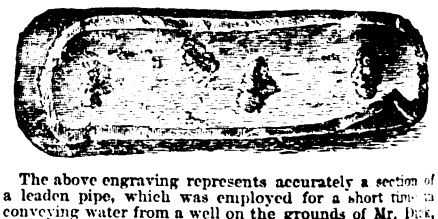

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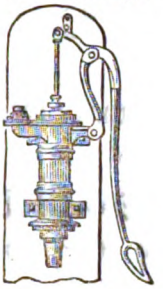

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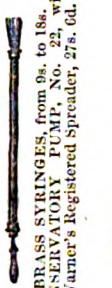

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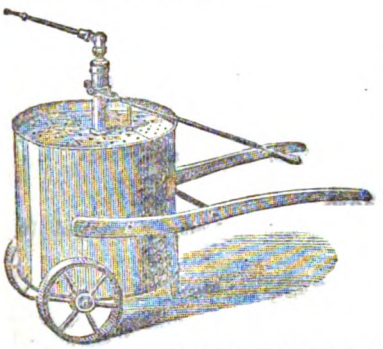

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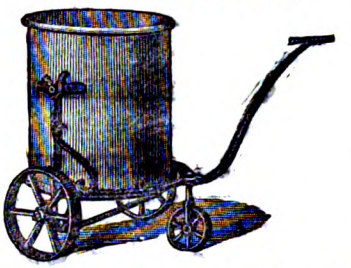

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These Counters register the number of revolutions made by an engine or other mechanism. They may be used for ascertaining the duty of Pumping Engines and Water-wheels; the revolutions on board a steam-vessel; to calculate the slip of the propeller; and in a locomotive to test the slip of the wheels.

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AND

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Communications to be sent to the Patentee, J. SCOTT, 111 Drummond Street, Euston Square, London, N.W. (48)

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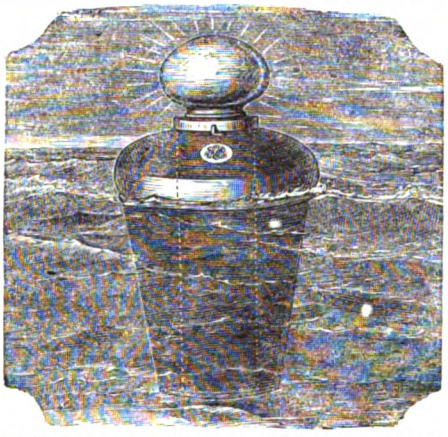

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PATENT

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The RECORD BUOY is intended to be kept in some place available for instant use, and to be thrown overboard from a sinking ship, or a Vessel on Fire, so as to intimate disaster, having a paper inserted therein, already filled up with the Ship's Name, Port of Registry, Official Number, &c., and a few last words hastily written, intimating the nature of the calamity, with any further information that can be given at such a time. It has capacity and buoyancy to contain besides these, the Log Book, and several pounds' weight of Papers or Valuables. It is lined with Cork between the Cylinder and outside case, so that, although waterlogged, it will not sink, but keep afloat for a long time, probably for years.

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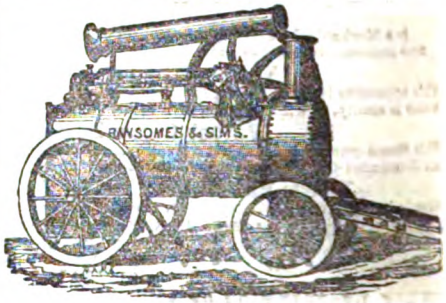
18th May, 1859. (264)



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AGRICULTURAL & GENERAL ENGINEERS

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

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By order,
G. SAWARD, Secretary.
Atlantic Telegraph Company, 22 Old-Broad-street, E.C., London, July 29, 1859. (323)

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2½	,,	,,	0	9	— 0	10	
3	,,	,,	1	0	— 1	2	
4	,,	,,	1	6	— 1	8	
5	,,	,,	1	10	— 2	1	
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6	,,	,,	4	6	— 4	10	
7	,,	,,	5	4	— 5	10	
8	,,	,,	6	6	— 7	0	
9	,,	,,	7	6	— 8	0	
10	,,	,,	8	6	— 9	0	
,,	,,	,,	,,	,,	— ,,	,,	
,,	,,	,,	,,	,,	— ,,	,,	

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4	,,	,,	2	10	— 3	2	
4½	,,	,,	3	0	— 3	3	
5	,,	,,	3	4	— 3	8	
5½	,,	,,	3	6	— 3	9	
6	,,	,,	3	9	— 4	3	
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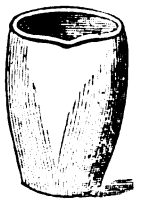

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NOTICES.

Boat-Lowering Apparatus.—We are reluctantly compelled to defer the publication of a long letter, received from Mr. Charles Clifford, until next week.

The Mechanics' Magazine will be sent free by post to all subscribers of £1 1s. 8d., annually, *payable in advance*. Post Office Orders to be made payable to R. A. Brooman, at the Post Office, Fleet Street, London, E.C.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and or 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements. To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

The demand for Mr. E. J. Reed's paper—

On the Modifications which the Ships of the Royal Navy have Undergone during the Present Century, in respect of Dimensions, Form, Means of Propulsion, and Power of Attack and Defence,"

has been so great that the Journal of the Society of Arts, the Mechanics' Magazine, and all other Scientific Journals in which it appeared in December last, are now out of print. The demand still continuing, it has been deemed desirable to reprint it in a separate form. An 8vo. edition of it, in large type, and on fine paper, has, therefore, been prepared, and may now be had at the Office of this Magazine, price 1s.

PRICES CURRENT OF METALS.

London, 5th August, 1859.

	£ s. d.	£ s. d.	Dis. p. ct
IRON, Rails in Wales and N. of England ..... pr. ton	6 0 0 to	.	nett
Welsh Bars, in Wales .. „	5 15 0 „	6 0 0	3
Staf. Bars at the Works „	7 0 0 „	7 10 0	2½
„ Hoops ..... „	8 0 0 „	8 10 0	„
„ Sheets, Singles .. „	8 10 0 „	9 0 0	„
„ Nail Rods ..... „	7 0 0 „	7 10 0	„
„ Boiler Plates .... „	8 10 0 „	9 0 0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow..... „	2 12 3 „	2 12 6	nett
Do. No. 1, Good Brands „	2 12 0 „	2 15 0	„
Scotch Bars ..... „	7 0 0 „	7 15 0	2
Swedish Bars, in London „	13 10 0 „	15 0 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 12		3
Tough Cake and Tile „ ton	107 10 0		„
Best Selected..... „	110 10 0		„
Australian ..... „	111 10 0 „	112 10 0	„
South American .... „	105 0 0		„
Yellow Metal Sheathing.....per lb.	0 0 10		„
STEEL, Swedish Keg .....pr. ton	18 15 0 „	19 0 0	2½
„ Faggot ..... „	20 15 0 „	21 0 0	„
TIN, English, Block .....pr. cwt.	6 18 0		2½
„ Bar..... „	6 19 0		„
Foreign, Banca ..... „	7 6 0		nett
„ Straits..... „	7 0 0		„
TINPLATES, Charcoal, I.C. ..pr. box	1 13 0 „		3
„ Coke, I.C. ..... „	1 7 0 „		„
LEAD, Pig, English .....pr. ton	22 15 0 „	23 5 0	2½
„ Spanish ..... „	22 0 0 „	22 10 0	„
„ Sheet ..... „	23 15 0 „	24 0 0	„
SPELTER, on the spot .....pr. ton	21 0 0 „	21 5 0	nett
for arrival..... „	21 0 0	21 5 0	„
ZINC, English, Sheet ..... „	28 0 0		1½
QUICKSILVER .....per btl.	7 0 0		1½

Remarks.—Prices of Metals are steady, with a moderate business doing.

LAWRIE AND HAGGER, Metal Brokers.

33 Lombard-street, E.C.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

Railway, *Scotland*.—For the construction of the Wilson Town Branches of the Caledonian, to the Wilson Town Mineral Fields, a distance of 2¼ miles, including earthwork, masonry, &c. Plans, &c., Mr. G. Graham, Engineer, Buchanan-street Station, Glasgow, to August 16, where tenders to the Secretary, 302 Buchanan-street.

Sewers, *Limehouse District*.—Certain intended brick and pipe sewers, and maintenance for 12 months. Plans and forms, Board-office, White Horse-street, Commercial-road East. Tenders August 16.

Church, *Maidstone*.—For the erection of the new district church of St. Paul's. Drawings at offices of Messrs. Pack and Stephens, High-street, Maidstone. Tenders to August 22.

Church, *Chew Magna*, near *Bristol*.—For the restoration and re-seating of Chew Magna church. Plans at the vestry-room. Tenders to August 13th.

Cathedral, *Armagh*.—For the roofing, slating, ceiling, glazing, &c. Plans at the college. Tenders to August 11th.

Mabslough Castle, near *Glasbury, Radnorshire*.—For erecting an eastern wing, stabling, coach house, &c. Plans at offices of Mr. Rawson, Glanhenwye, near Glasbury, and of Mr. T. Nicholson, Architect, Hereford. Tenders to August 10th.

Police Stations at *Handsworth* and *Smethwick*.—Plans, &c., office of Mr. C. Trubshaw, County Surveyor. Tenders to Clerk of the Peace's office, Stafford, 20th August.

Parochial Meeting-House, *Forgue, Aberdeenshire*.—For the masons', carpenters', slaters', and other work. Plans, &c., at the Manse. Tenders to August 12th.

Farm Buildings, *Milton* of *Kinnay, Aberdeenshire*.—For the masons', carpenters', and slaters' works of additions on the farm of Milton of Kinnay. Plans, &c., Mr. A. Leslie, Land Steward, Kinnay, Aberdeen. Tenders to August 10th.

Colliers' Cottages, *near Morpeth, Newcastle-upon-Tyne*.—For twenty-five cottages at Howard's West Hartley colliery. Particulars at the Colliery Office, and a specimen cottage at the colliery. Tenders to the 8th instant.

Ironmongery, *East India Company*.—Conditions at the Secretariat office; where proposals at eleven on the 12th instant.

Broken Guernsey Granite, *Limehouse District*.—To be delivered on the roads and streets of the district. Particulars and forms, Offices, White Horse-street, Commercial-road East, August 15.

Foreman Moulder.—Accustomed to first-class engine and tool work. Box 32, Post-office, Manchester.

A Millwright.—To take charge of the machinery of a works in Staffordshire. Liberal wages to a good man. "T.," Post-office, Tipton.

Glass Cutters.—Twelve first-class workmen. Messrs. Cole and Co., Falcon Flint-glass Works, Shelton, Staffordshire.

Civil Engineers and Contractor's Agents.—Wanted several well-qualified engineers to assist in making a railway in Berar, in India. Salary £600 a-year, and passage paid out. Apply by letter, with certificates, to A. H. Lee, Esq., the College, Edinburgh.

Gas Manager.—Immediately by the Gibraltar Gas Company. Salary £150 per annum, with free house, coal, and gas. Apply to R. Laidlaw and Son, Gas Engineers, Glasgow.

Stone Breakwater, *Scotland*.—For the prolongation of the Eastern Stone Breakwater, from the present termination of the outer arm to the shore, a distance of 700 yards, at the Granton Harbour, near Edinburgh. Plans, &c., Mr. J. Hawkins, Engineer, Granton Harbour. Tenders to Messrs. Gibson, W. S., 12 Charlotte-street, Edinburgh, August 13. Proprietor, the Duke of Buccleuch and Queensbury.

PATENT WEDGE and GROOVED SURFACE FRICTIONAL GEARING.—The PATENT FRICTIONAL GEARING COMPANY, Proprietors of ROBERTSON'S WEDGE SURFACE FRICTIONAL GEARING PATENTS, grant Licences to Users of Machinery, for the unlimited use of the System in their Works, on very moderate terms, enabling them to make or order from any Mechanician the Machinery they require.

The Company possess Five Patents relating to this Frictional System, including (in addition to their Bevel and Mitre Wheels) a System of Disc Clutches and Clutch Movements, Wheel Clutching, Reversing, Differential, Speed Ring, Varying Speed, and Break Movements, and of Shafting, Pillow Blocks, Shafting Hangers, &c.

Frictional Wheels thus formed are applicable to the heaviest as well as the lightest kind of work, and, in addition to their being extensively in use for ordinary gearing purposes, have been in use for a considerable time applied to Mills for Rolling Iron, the Screw-Propeller, Incline-Winding Engines, Saw Mills, Pumping Engines, Flax Scutchers, Fan Blowers, Calico-Printing Machinery, Steam Winches, Cranes, Hoists, &c.

This system gives great facilities for simplifying Machines, and for mechanical combination, and has the advantage of being noiseless and cleanly, there being no oil or grease used on the wheels. Wheel Catalogues and Circulars, giving particulars, sent free by Post; also, a list of manufacturing Agents, and information regarding those who, from locality or experience, are best able to execute orders for the description of work required.

Office, 20 Buchanan-street, Glasgow. 146)

MATHEMATICAL DRAWING INSTRUMENTS, RULES, TAPES, CHAINS, LEVELS, THEODOLITES, BOX SEXTANTS, PRISMATIC and POCKET COMPASSES. Price Lists of the above articles sent post free, by John Archbutt, 20 Westminster Bridge Road, Lambeth, near Astley's Theatre. Every article warranted, and the prices will be found considerably lower than ever before charged for articles of similar quality. Routledge's Engineers' Slide Rules, 4s. 6d. each; Hawthorn's ditto, 5s. 6d.; Carpenters' Rules from 1s. (148)

A VALUABLE PATENT to be DISPOSED OF.—The Patentee will either dispose of the Patent or grant Licences to any party wishing to manufacture, or would join a person with capital to carry out the Patent.

Address, A. Z., Mechanics' Magazine Office, 166 Fleet-street. (163)

TO BRASS FOUNDERS.

TO BE SOLD, the Patent-right of a New and Highly-approved EQUILIBRIUM WATER COCK or VALVE, suitable for Steam Boiler Feed Pipes, or any cases where the valve is required to be opened against pressure.

Address H., Mechanics' Magazine Office, 166 Fleet-st., where a Drawing may be seen. (151)

BIRMINGHAM WAGGON COMPANY (LIMITED) has RAILWAY WAGGONS for HIRE. Apply to the Secretary, 3 Newhall-street, Birmingham. (276)

WILLIAM WARNE & CO.,
Manufacturers of all descriptions of
VULCANIZED INDIA-RUBBER,
SHEETS, WASHERS,
HOSE-PIPES, TUBINGS, ETC.;
Sole Manufacturers of
WARNE'S PATENT INDIA-RUBBER TUBULAR MATS,

For Doorways, Stairs, Baths, Carriages, Ships, &c., which never clog, require no beating, and, unlike all other Mats, are readily cleansed by water. Indestructible by damp, these Mats are especially suitable for uncovered Passages, and out of door purposes. Seat Mats, Housemaids' Mats, and Brushes for wooden and stone floors.

Sole Manufacturers of
WARNE'S PATENT MINERALISED IMPROVED KAMPTULICON,

Possessing advantages over all the ordinary makes, in exceeding toughness, and flexibility, and consequent durability, while neither heat nor cold has effect upon it. Widths, 3/4s., 4/4s., 6/4s., and 7/4s. Substances, ⅛, ¼, and thicker if required. Length, 20 to 25 yards.

Patentees of the Red Mineralised India Rubber—the only Rubber not affected by Oil.

Warehouse, 9 Gresham-street West, E.C. Mills, Tottenham, N. (244)

CONDY'S PATENT FLUID, or NATURAL DISINFECTANT,
Not only Deodorizes but Disinfects perfectly, and destroys for ever the cause of infection.

Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.

This fluid has been examined and reported upon by the Board of Health, all the most eminent Men and Chemists of the day, in all cases in the most satisfactory manner possible.

The Public are recommended to use this Fluid, properly diluted with water, frequently and habitually in larders, sculleries, dairies, musty cakes, sick rooms, close places, &c., as it has numerous advantages, and can be used with certain immediate success and perfect safety.

Sold in Quart Bottles, 4s.; Pints, 2s.; Half-pints, 1s.; and in bulk, 10s. per Gallon.

Free to Railway on receipt of Order or Stamps. (238)

FUEL AND STEAM ECONOMY.—Apply to Mr. Lee Stevens, C.E., 1 Fish-street-hill, E.C. 243)

RICHARD BAIRD, GENERAL COMMISSION AGENT, and CONTRACTOR for all descriptions of RAILWAY PLANT and STORES.
13 DOCK-STREET, DUNDEE. (280)

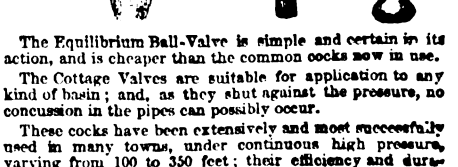
BRASS AND COPPER TUBES.

MUNTZ'S PATENT SOLID ROLLED BRASS AND COPPER TUBES, now extensively used on the principal Home and Foreign Railways, and for Marine Boilers by the Government and leading Steam-Packet Companies, are cheaper and more durable than the ordinary tubes.

Address GEORGE RICHARDSON and CO.,
New Broad-street, E.C. (277

HIGH-PRESSURE VALVE-COCKS
LAMBERT'S PATENT.

Equilibrium Ball Valve. Cottage Closet Valve.



The Equilibrium Ball-Valve is simple and certain in its action, and is cheaper than the common cocks now in use.

The Cottage Valves are suitable for application to any kind of basin; and, as they shut against the pressure, no concussion in the pipes can possibly occur.

These cocks have been extensively and most successfully used in many towns, under continuous high pressure, varying from 100 to 350 feet; their efficiency and durability is, by experience, established.

THOMAS LAMBERT and SON,
Brass Founders, Short-street, New-cut, Lambeth. (80)

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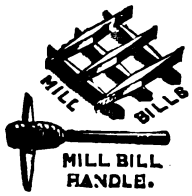
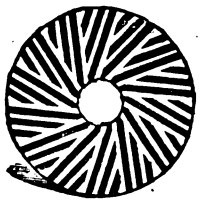
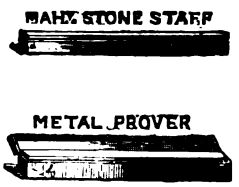
IMPORTANT TO MILLERS AND OTHERS.

ESTABLISHED UPWARDS OF HALF A CENTURY.







HUGHES AND SONS, MILLSTONE MAKERS,

Great Dover-street and Swan-street, Borough, London, S.E.,

BEG to call the attention of Millers, Millwrights, Engineers, Agricultural Machinists, Cement Manufacturers, Distillers, Merchants, and others, to their extensive Stock of FRENCH BURR MILLSTONES, manufactured from a superior Brown Burr, of quality, workmanship, and finish not to be equalled by any house in England. Also to their Stock of French Burrs of various quality and texture, selected by them in person at the best quarries in France, where their choice is unlimited. The extent of their business requiring several thousand Burr Stones annually more than any other Millstone Maker in England (as may be seen by reference to the Custom House "Shipping List"), places them in a position to execute all orders entrusted to them to satisfaction.

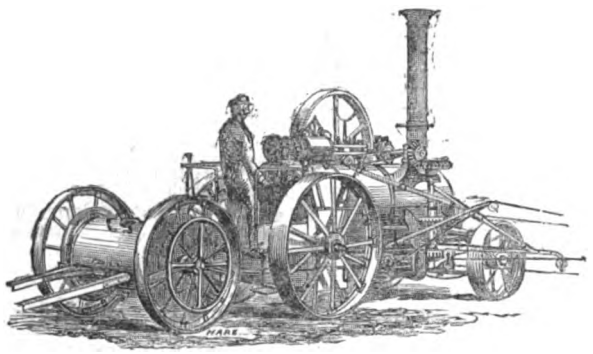
H. and S. are also Importers of Peak, Cologne, Granite, and Grindstones direct from the quarries; and have always on hand at their works a varied assortment of Flour Machines, Smut Machines, Bolting Machines, Separators, Kilns, &c.; Wove Wire for Screen Work; Wire Webb for Flour Cylinders; Improved Square Smut Wire, wove by machinery, with rough surface, made to cover any size cylinder in one sheet; Bolting Cloths; Best Oak-tanned Leather Millbands, well stretched and riveted at joints; Webbing for Elevators; Elevating Buckets; Screw Jacks, Proved-iron Hoisting Chain; Iron and Brass Sheave Blocks; Iron and Slate Provers; Mahogany Staffs; Sack and Heaving Barrows; Cast Steel Mill Bills, of finest Silver Steel; Flour Machine Brushes, made of the best Russian Bristles; and all other articles used in Mills.

HUGHES and SONS employ none but the best Workmen;

and wish to draw attention to the fact that by employing no Travellers, thereby avoiding the necessarily high expenses connected therewith, they are ina position to give their Customers all the advantages from this circumstance, as well as those arising from adequate capital, combined with practical judgment.

*** ALL GOODS DELIVERED FREE TO WHARVES OR RAILWAYS IN LONDON. (240)

FOWLER'S PATENT STEAM PLOUGH.



The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching Plough, and Scarifier.

For further particulars, Illustrated Catalogues, and Prices, apply to

JOHN FOWLER, JUN., 28 CORNHILL, LONDON, E.C.

RICHARD GARRETT AND SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

Beg respectfully to call attention to their

NEWLY-INVENTED "FIXED" AND "PORTABLE" COMBINED FINISHING, THRASHING, AND DRESSING MACHINES.

THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit for market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel may be stated as follows:

1st. Their compactness; being fully one-third less in size and bulk than the ordinary Machines hitherto in use for the same purpose.

2nd. The great reduction in the number of wearing parts. In these Improved Machines more than one-half the spindles, pulleys, bearings, and driving belts required for the ordinary Machines are dispensed with.

3rd. The novel arrangement by which the Dressing Apparatus is instantly varied, while the Machine is at work, to suit all kinds and conditions of grain.

4th. The very important saving in the cost of keeping the Machines in working order, consequent on the great reduction in the number of wearing parts.

N.B.—Catalogues in English, French, or German can be obtained FREE, on application being made to R. G. & SONS, at

LEISTON WORKS, SAXMUNDHAM, SUFFOLK. (314)

YORKSHIRE TYRE & AXLE WORKS, ROTHERHAM.

LOCOMOTIVE TYRE-BARS of every description for Engines, Carriages, and Railway Waggon Wheels.

STEEL-IRON for Springs. MERCHANT and other Irons manufactured. WM. F. HOYLE, Proprietor. (278

PATENT LEVER BREAKS for RAILWAY WAGGONS, doing away with the objectionable Break Rack. Can be applied to existing stock at a trifling expense. Royalty moderate.

Models can be seen at 34 Great George-street, Westminster, and the Breaks in action at the Works of the Railway Carriage Company at the Peterborough Station, on the Eastern Counties Railway; the Rugby Station, London and North-Western Railway; the Cardiff Docks Station, Taff Vale Railway; and at the Works, Oldbury, near Birmingham, where all communications are requested to be sent. (275)

RANSOME'S PATENT IMPERISHABLE SILICEOUS STONE.—Chimney-Pieces, Balustrades, Capitals, Trusses, Terminals, Fountains, Vases Monuments, &c., of great beauty, at the most reasonable prices.

For Particulars, Specimens, Illustrations, and Agencies, apply to Mr. Frederick Ransome, Whitehall Wharf, Cannon-row, Westminster; or Patent Stone Works, Ipswich. A Liberal Discount allowed to the Trade or to Shippers. (147)

VULCANISED INDIA-RUBBER MACHINE BANDING is NOT AFFECTED BY WET, HEAT, OR COLD; does not stretch nor slip on the pulleys. HOSES for BREWERIES, &c., will NOT impart TASTE, SMELL, or COLOUR: also for conducting, or steam purposes. Washers, Valves, Sheets, Printing Blankets, &c., in Stock. Other Articles made to order. All Goods warranted to stand 300° Fahrenheit.

N.B.—Sole Contractors to the Lords Commissioners of the Admiralty.

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Important to every man who keeps

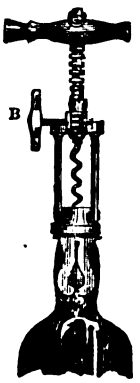
THORLEY'S FOOD FOR CATTLE,

77, NEWGATE STREET, LONDON

Price 50s. per Cask, containing 448 Feeds

Carriage paid to any Station.

A Pamphlet, Post-free on application. (133)



NO ADJUSTMENT REQUIRED.—You have only to place one of

LUND'S

LONDON RACK CORK SCREWS

on the neck of a bottle, and it is ready for use. Some of these Cork Screws are fitted with Patent Spring Ends to embrace the neck of the bottle, and so direct the worm through the centre of the cork.

Sold by the Patentee at 56 and 57 Cornhill, and 23 and 24 Fleet-street, London; and may be had at all Cutlers' and Ironmongers'. (254)

CAUTION.

TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine

SMITH'S PATENT DOOR SPRINGS.

For Swing Doors, are stamped with Name and Address, thus—

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and that Springs thus marked are warranted.

SMITH'S PATENT WEATHER-TIGHT CASEMENT FASTENING AND SILL-BARS

are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. (193)

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TO STEAM SHIP OWNERS, ENGINEERS, AND OTHERS.

How's Patent Steam Engine Counters, can be read at sight.

These Counters register the number of revolutions made by an engine or other mechanism. They may be used for ascertaining the duty of Pumping Engines and Water-wheels; the revolutions on board a steam-vessel; to calculate the slip of the propeller; and in a locomotive to test the slip of the wheels.

How's Patent Salinometer, for Steam Boilers using Salt Water.

By these, the density of the water in the Boiler is at all times accurately shown, and a saving of boiler and fuel is effected. They are adopted by the Admiralty, the Honorable Trinity Corporation, and others. Copies of Testimonials from Messrs. Penn, Messrs. Maudslay, and others, will be forwarded on application.

How's Engine-Room Telegraph, for communicating between Captain and Engineer. Society of Arts Prize Medal, 1855.

is a Mechanical Telegraph, and by its peculiar construction, error or misunderstanding is rendered impossible. It now extensively adopted, and gives great satisfaction.

How's Patent Fresh Water Apparatus for Ships' Use.

This apparatus is designed for the distillation of Fresh from Salt Water; and on long voyages, and where the supply of water is scanty, it will be found invaluable. Testimonials may be seen.

Patent Steam Pump and Fire-Engine for Ships' Use.

This Steam-pump occupies but a small space; works perfectly noiselessly, and throws an immense volume of water. An Illustrated Circular of Fresh Water Apparatus and Steam-pump combined, free on application.

How's Patent Machine for Cutting Bolts, Rods, Spindles, Wire, &c.

Simple in construction, inexpensive, occupies but little space, and will not easily get out of order.

A Pamphlet Illustrative of the above, sent free by post, on application to

A. P. HOW, ENGINEER,

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EVERY DESCRIPTION OF ENGINEERS' TOOLS, ENGINE ROOM STORES, &c. &c., SUPPLIED. (89)

MEDALS AWARDED TO

THOMAS GLOVER'S PATENT DRY GAS-METERS.

VIZ.:

GREAT EXHIBITION, LONDON, 1851. | NEW YORK EXHIBITION, 1855.
AND PARIS UNIVERSAL EXHIBITION, 1855.

LONDON, March 25, 1859.

THOMAS GLOVER takes this opportunity of thanking Gas Companies and his other Customers for the very liberal support and patronage he has received during the past year, which has far exceeded his most sanguine anticipations, having sold a greater number of his PATENT DRY GAS-METERS since the dissolution of his partnership with Mr. Croll than he was ever previously enabled to do in any one year.

THOMAS GLOVER confines his sole attention to the business of Gas-Meter Making. The propriety of his doing so is satisfactorily proved by his success; and, without the practice of any quackery, or any attempt to delude the public by an absurd exhibition of "Old and New Valves," his Meters are in general use by the Metropolitan Gas and other Companies in this Country and abroad. For example, one Metropolitan Company have now in use above 12,500 of his Patent Dry Gas-Meters; some of these Meters have been fixed for Fourteen Years, and are still in working order, without complaint from either the Company or the Consumer.

THOMAS GLOVER thinks it necessary to put Gas Companies on their guard against parties selling Patent Dry Gas-Meters constructed in imitation of his, but unskilfully made on erroneous principles, and with improper and unsuitable materials.

THOMAS GLOVER'S Workshops are now the most extensive in this or any other country, and he is thereby enabled promptly to execute orders to any extent required. Purchasers may at any time inspect his Works and the Materials of which his Meters are constructed. He is ready to enter into Contracts with Gas Companies and others to uphold their Stock of his Meters for Twenty Years at an annual charge varying from 2½ to 5 per cent., and to leave always in the hands of Gas Companies Three Years' charge for upholding, as a guarantee for the fulfilment of the Contract.

THOMAS GLOVER,

PATENT DRY GAS-METER MANUFACTURER,

SUFFOLK STREET, CLERKENWELL GREEN, AND
ALLEN STREET, GOSWELL STREET, E.C. (293)

D. HULETT & CO.,

55 and 56 HIGH HOLBORN, LONDON,

Patentees and Manufacturers of the only good Mercurial Gas Regulator,

INVITE the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

Manufacturers of

GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

Double Cone, Albert, Shadowless, and every description of Burner, Union Jets, Batswings, &c.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas-Apparatus.

CAST AND WROUGHT-IRON PIPE, BLACK AND GALVANISED. COPPER, TIN, BRASS, AND COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER,

for clearing out Mains, Services, and Interior Fittings—60s. net.

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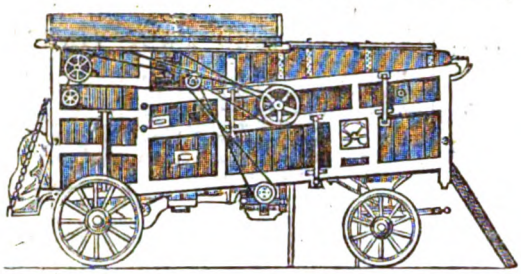

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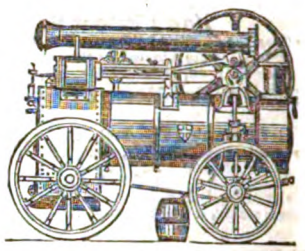

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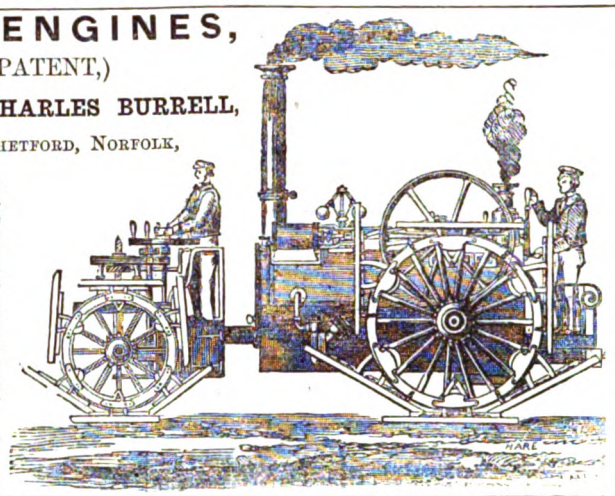

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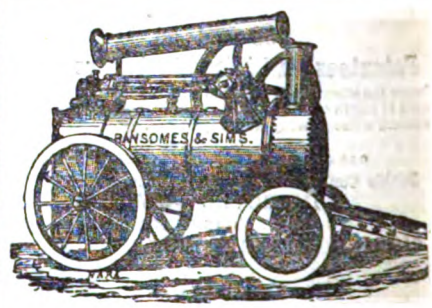

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 33. [NEW SERIES.]

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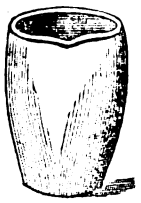

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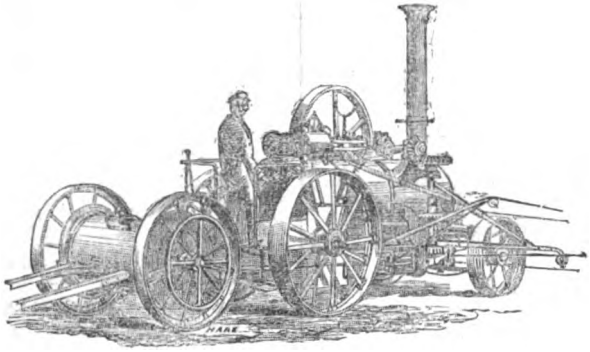

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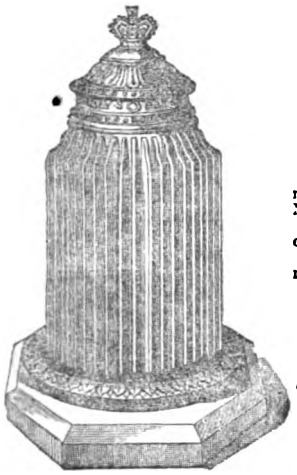

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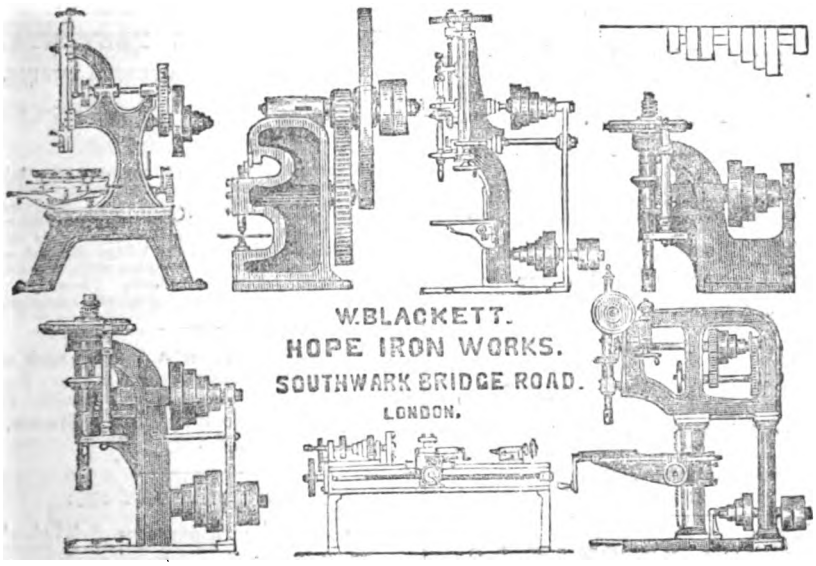

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	s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
1 inch, per foot,	0 3 to 0	4	3 inch., per foot	2 2 to 2	6	3 inch., per foot,	2 0 to 2	2
1½ „ „	0 5 — 0	6	4 „ „	3 0 — 3	4	3½ „ „	2 4 — 2	9
2 „ „	0 7 — 0	8	5 „ „	3 9 — 4	1	4 „ „	2 10 — 3	2
2½ „ „	0 9 — 0	10	6 „ „	4 6 — 4	10	4½ „ „	3 0 — 3	3
3 „ „	1 0 — 1	2	7 „ „	5 4 — 5	10	5 „ „	3 4 — 3	8
4 „ „	1 6 — 1	8	8 „ „	6 6 — 7	0	5½ „ „	3 6 — 3	9
5 „ „	1 10 — 2	1	9 „ „	7 6 — 8	0	6 „ „	3 9 — 4	3
6 „ „	2 4 — 2	7	10 „ „	8 6 — 9	0	6½ „ „	4 1 — 4	4
7 „ „	2 10 — 3	2	„ „ „	„ „ — „	„	7 „ „	4 4 — 4	10
8 „ „	3 4 — 3	8	„ „ „	„ „ — „	„	8 „ „	4 6 — 5	6

N.B.—These Bands are celebrated for being well stitched and riveted at joints, and being also of equal thickness throughout.

H. & SONS beg to call particular attention to their having always on hand a Large Assortment of Improved Screw-socket Rivets, varying in size, from ⅛-inch upwards, for fastening Mill Bands, Elevator Cups, &c., also White and Brown Laces. (206)

JOHN HENDERSON PORTER,

ENGINEER AND CONTRACTOR,

PATENTEE OF VARIOUS IMPROVEMENTS IN THE CONSTRUCTION OF

IRON BUILDINGS, BRIDGES, ROOFS, AND FLOORS,

IRON BUILDING AND ROOFING WORKS,

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Iron Punts for Sugar Estates, &c., &c.
Tanks, Casks, and Barrels.
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Hay Racks, Mangers, Sheep Cribs, and Cattle Troughs.
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Plans and Estimates will be furnished on Application.

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SCOTT'S

PATENT GRASS SEED SEPARATOR,

which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

PERENNIAL AND ITALIAN RYE-GRASS, &c.,

AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

These Machines were admittedly the most novel, and, at the same time, the most useful and important to the Farmer of any exhibited at the late SMITHFIELD CLUB SHOW.

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Mr. T. MIDDLETON, Engineer, Southwark.

Communications to be sent to the Patentee, J. SCOTT, 111 Drummond Street, Euston Square, London, N.W. (48)

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By Royal Letters Patent.

T. SUFFIELD AND CO.

Call the particular attention of

SHIP-OWNERS, SHIP-BUILDERS, AND COMMANDERS OF STEAM AND SAILING VESSELS,

to the Simple and Efficient Arrangements of their

PATENT PUMPS AND FIRE-ENGINES,

Both Fixed and Portable, with PATENT VALVES and other Improvements.

These Pumps are free from that liability to choke which is common to other Pumps, and their Working Parts are not susceptible of derangement either from wear or from being long out of use. They pass entirely through them, with ease, any substance that may enter the Suction Pipes. The Novelties in these Pumps are their adaptation to the varied duties of Ships' Pumps, the facilities they afford for Cleansing the Suction Pipes, and for Sounding or Examining the Valves; the readiness with which they may be used for Ventilating the Bilge, or for acting as a Syphon either for Watering the Ship, or for extinguishing Accidental Fires on board; the rapidity with which they can be converted into Fire Pumps, or be applied to the Washing of Decks; and their capability of Pumping from Several Compartments. Also, to their

MARINE ENGINE-ROOM TELEGRAPHS,

Which excelled all others in the recent series of Trials in Her Majesty's Navy at Sheerness. These invaluable instruments have been supplied and sent to almost all parts of the world, and in no case has there been any complaint of their working.

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Suitable for testing the speed of all classes of machinery.

IMPROVED

HYDROMETERS, SALINOMETERS,

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Made to act when placed either above or below the water level. These Closets are simple, efficient, and mechanically arranged for their various requirements, and are not liable to derangement.

IMPROVED STEAM COCKS, WATER GAUGES,

And all kinds of Steam Fittings of the very best quality. As a large Stock of every variety of this class of goods has been much sought after, we trust the present one (especially considering it can be so readily examined in our new premises) will be fully appreciated and meet with the attention it deserves

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(For which we are the sole appointed Agents) and which after having been tested for some time, are now patronised by the Lords of the Admiralty Besides BOURDON'S and other Guages which are also supplied by us to order.

IMPROVED STEAM WHISTLES, LUBRICATORS, LAMPS, OIL FEEDERS,

And Stores of every description supplied on the shortest notice.

T. SUFFIELD & CO.

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ASSORTED STORES FOR MARINE PURPOSES.

They keep a Large Stock of Goods, of their own Manufacture and from the Best Makers. constantly on view; so that by a visit to their Works or Depôt, much valuable time may be saved by Managers, Engineers, and other Gentlemen who may require such Stores, together with a further saving in the cost of the Articles.

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LONDON.

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RICHARD GARRETT & SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

(ESTABLISHED A.D. 1778),

EARNESTLY solicit the continued support of their numerous Friends, Agriculturists, Shippers, and others; the additions made to their Works during the present year, in the erection of new sets of Workshops, fitted with the best mechanical appliances for producing Machinery of the most improved construction, expeditiously and economically, justifies their soliciting increased support, while their leading reputation as Inventors and Manufacturers of FIRST CLASS Agricultural Machinery, is a sufficient guarantee that every Machine supplied from Leiston Works will prove to the entire satisfaction of the purchaser.

R. G. & S. are now manufacturing the following Machines and Implements, which they guarantee to be thoroughly efficient in every respect:—

PORTABLE AND FIXED STEAM ENGINES. } From 4 to 40 Horse Power, suited for every kind of work
SELF-PROPELLING AND TRACTION ENGINES. } to which Steam Power is applied.
STONE GRINDING MILLS.
MORTAR AND PUG MILLS.
MILLWRIGHTS' WORK of all kinds.
SAWING MACHINERY, from 4 to 20 Horse Power.
BRICK AND TILE MACHINES.

IMPROVED SETS OF FARM MACHINERY, for Large Occupations.
PORTABLE AND FIXED MACHINERY, for Thrashing and Dressing Corn.
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CORN DRESSING MACHINES, for Hand, Horse, Water, and Steam Power.
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PATENT TURNIP CUTTING AND PULPING MACHINES.

THE PRIZE CORN AND SEED DRILLS.
PRIZE CORN AND SEED DRILLS WITH MANURE APPARATUS.
PRIZE SEED AND MANURE DRILLS.
LIQUID, SEED, AND MANURE DROP DRILLS.
CHAMBER'S PATENT BROADCAST MANURE DISTRIBUTOR.
GARRETT'S PATENT HORSE HOE for all Crops.
PATENT REVOLVING HOES for Root Crops.
IMPROVED PLOUGHS AND REAPING MACHINES.
&c. &c. &c.

Of which full detailed particulars will be found in R. G. & SONS' ILLUSTRATED CATALOGUE, sent postage free to any address, in English, French, or German; and any of the above Machines will be shown in operation at R. G. & Sons' Farm, near the Works, on their receiving a few days' notice.

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D. HULETT & CO.,

55 and 56 HIGH HOLBORN, LONDON,

Patentees and Manufacturers of the only good Mercurial Gas Regulator,

INVITE the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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Double Cone, Albert, Shadowless, and every description of Burner, Union Jets, Batswings, &c.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas-Apparatus.

CAST AND WROUGHT-IRON PIPE, BLACK AND GALVANISED. COPPER, TIN, BRASS, AND COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER,

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BOYLE'S PATENT SILVERED GLASS COMBINATION REFLECTORS AND OUTSIDE LANTERNS.

Sole Manufacturers of CHURCH & MANN'S PHOTOMETER.

Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s. (294)

MEDALS AWARDED TO

THOMAS GLOVER'S PATENT DRY GAS-METERS.

VIZ.:

GREAT EXHIBITION, LONDON, 1851. | NEW YORK EXHIBITION, 1855.
AND PARIS UNIVERSAL EXHIBITION, 1855.

LONDON, March 25, 1859.

THOMAS GLOVER takes this opportunity of thanking Gas Companies and his other Customers for the very liberal support and patronage he has received during the past year, which has far exceeded his most sanguine anticipations, having sold a greater number of his PATENT DRY GAS-METERS since the dissolution of his partnership with Mr. Croll than he was ever previously enabled to do in any one year.

THOMAS GLOVER confines his sole attention to the business of Gas-Meter Making. The propriety of his doing so is satisfactorily proved by his success; and, without the practice of any quackery, or any attempt to delude the public by an absurd exhibition of "Old and New Valves," his Meters are in general use by the Metropolitan Gas and other Companies in this Country and abroad. For example, one Metropolitan Company have now in use above **12,500** of his Patent Dry Gas-Meters; some of these Meters have been fixed for Fourteen Years, and are still in working order, without complaint from either the Company or the Consumer.

THOMAS GLOVER thinks it necessary to put Gas Companies on their guard against parties selling Patent Dry Gas-Meters constructed in imitation of his, but unskilfully made on erroneous principles, and with improper and unsuitable materials.

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THOMAS GLOVER,

PATENT DRY GAS-METER MANUFACTURER,

SUFFOLK STREET, CLERKENWELL GREEN, AND
ALLEN STREET, GOSWELL STREET, E.C. (293)

VINEGAR.—Patronised by Her Majesty's Government.

CONDY'S PATENT PURE CONCENTRATED MALT VINEGAR.

Families, by using this delicious VINEGAR, insure purity and effect a saving of 50 per cent. See "Report of Dr. Letheby, City Officer of Health, Dr. Hassall, of the 'Lancet' Commission, and others." Sold by the Trade, in Bottles, labelled and capsuled. Wholesale—63 King William-street, London-bridge, E.C. Six Quart Samples sent free to any Railway for 3s. 6d. (216)

ARTESIAN WELLS, BORING TOOLS, PUMPS, &c. Engineers, Architects, Surveyors, Builders or others requiring a good supply of Water may have any quantity procured by W. SPELLER, 14 York-street Blackfriars'-road, London, where may be had any quantity of Tools for Sinking or Boring, from 2 to 20 inches diameter, and from 100 to 2,000 feet depth; also Men and Tools to bore for Railroads, Minerals, &c., in any part of the world. Boring Tools and suitable Pipes for exportation, with full instructions for their use.

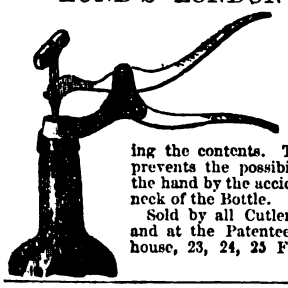
Builders, Contractors, Brickmakers, Barge and Ship Builders, and others, can be supplied with Wrought or Cast Iron Pumps, Double or Single, for excavation of Deep Wells, from 3 to 14 inches in the bore, and from 6 to 130 feet in length, to work by hand or Steam Power.

Hot-Water Apparatus for Conservatories, &c., on the most economical and improved principles.

Also Manufactory for Captain John Grant's much improved Cooking Apparatus. (44)

GLADSTONE & Co., CONTRACTOR and ENGINEERS.
2 John-Street, Minories, London, E.C.,
Are prepared to ESTIMATE FOR and CONSTRUCT BRIDGES, PIERS, JETTIES, &c., in Iron, Wood, or Stone. Also to supply Cranes, Girders, Turntables, and Railway Work and Plant generally. (199)

LUND'S LONDON LEVER



FOR Drawing Corks is the most simple and efficacious Instrument ever offered to the public for removing the Corks from Bottles without disturbing the contents. The use of this Lever prevents the possibility of any injury to the hand by the accidental breaking of the neck of the Bottle.

Sold by all Cutlers and Ironmongers, and at the Patentee's Wholesale Warehouse, 23, 24, 25 Fleet Street, London. (178)

VOKINS & HURD,

SEYMOUR HOUSE, JUBILEE PLACE,
CHELSEA.

HOT-HOUSE BUILDERS
AND
Hot-Water Apparatus Manufacturers.

Plans and Estimates forwarded on Application. (149)

CHUBB'S LOCKS, FIREPROOF SAFES, CASH AND DEED BOXES.
Complete lists of sizes and prices may be had on application
CHUBB AND SON,
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GLENFIELD PATENT STARCH,

USED IN THE ROYAL LAUNDRY,
AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.
WHEN YOU ASK FOR
GLENFIELD PATENT STARCH,
SEE THAT YOU GET IT,
as inferior kinds are often substituted.
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THE
SILVERTOWN INDIA-RUBBER WORKS
OPPOSITE
H. M. DOCKYARD, WOOLWICH.

INDIA-RUBBER MANUFACTURES

WITH ALL
RECENT IMPROVEMENTS.

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ISCA FOUNDRY COMPANY, OLD BARRACKS, NEWPORT, MON.
ENGINEERS, AND RAILWAY WAGGON BUILDERS.
Manufacturers of Switches, Points, and Crossings,
Chairs, Spikes, Bolts, and General Railway Fitting
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IMPORTANT TO MILLERS AND OTHERS.

ESTABLISHED UPWARDS OF HALF A CENTURY.

HUGHES AND SONS, MILLSTONE MAKERS,

Great Dover-street and Swan-street, Borough, London, S.E.,

BEG to call the attention of Millers, Millwrights, Engineers, Agricultural Machinists, Cement Manufacturers, Distillers, Merchants, and others, to their extensive Stock of FRENCH BURR MILLSTONES, manufactured from a superior Brown Burr, of quality, workmanship, and finish not to be equalled by any house in England. Also to their Stock of French Burrs of various quality and texture, selected by them in person at the best quarries in France, where their choice is unlimited. The extent of their business requiring several thousand Burr Stones annually more than any other Millstone Maker in England (as may be seen by reference to the Custom House "Shipping List"), places them in a position to execute all orders entrusted to them to satisfaction.

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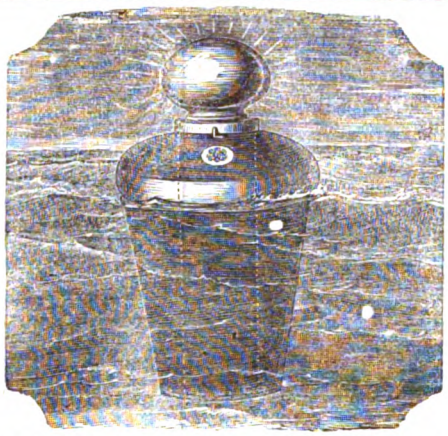
HUGHES and SONS employ none but the best Workmen;

and wish to draw attention to the fact that by employing no Travellers, thereby avoiding the necessarily high expenses connected therewith, they are in a position to give their Customers all the advantages from this circumstance, as well as those arising from adequate capital, combined with practical judgment.

*** ALL GOODS DELIVERED FREE TO WHARVES OR RAILWAYS IN LONDON. (240)

GRESHAM'S RECORD PATENT BUOY.



The RECORD BUOY is intended to be kept in some place available for instant use, and to be thrown overboard from a sinking ship, or a Vessel on Fire, so as to intimate disaster, having a paper inserted therein, already filled up with the Ship's Name, Port of Registry, Official Number, &c., and a few last words hastily written, intimating the nature of the calamity, with any further information that can be given at such a time. It has capacity and buoyancy to contain besides these, the Log Book, and several pounds' weight of Papers or Valuables. It is lined with Cork between the Cylinder and outside case, so that, although waterlogged, it will not sink, but keep afloat for a long time, probably for years.

In order to DISTINGUISH IT FROM ANY OTHER FLOATING SUBSTANCE, so that the Captain of a passing Ship may recognize it as an intimation of disaster, and consider it a sacred and imperative duty to pick it up and convey the information it contains according to the directions found within, it HAS RAISED CONSPICUOUSLY UPON ITS SURFACE A SILVERED GLOBE, which, owing to the reflection of the light, will make it visible at a great distance, and when dancing on the wave it shines, in fact, like a star in the firmament, and being distinguishable from anything else, its character cannot be mistaken.

It is furnished with ample directions to the finder how to act, and has Envelopes already directed to the proper authorities, who, on receipt thereof (and they should be transmitted by the first available means), will, after verifying them to prevent imposition, immediately convey the information to the owners of the lost Ship, to Lloyd's, and all parties concerned; and if a foreign ship, to the consul of the nation to which she belongs.

In order to establish uniformity, and to prevent the uncertainty and confusion which a multiplicity of Buoys of various forms might occasion, when their utility becomes apparent, and to make ESPECIAL RECOGNITION OF THESE UNDOUBTED, MR. JOHN GRESHAM, J.P. and Alderman of Hull, has Patented his Invention, and has arranged with the old-established Firm of

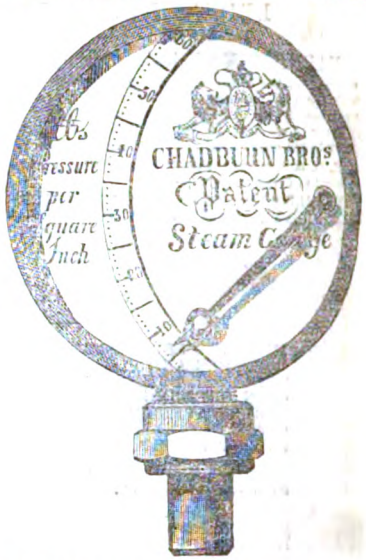
GEORGE AND JOSEPH OLIVER,
286 WAPPING, LONDON, E.,

TO MANUFACTURE AND SUPPLY THEM, AND TO WHOM ALL COMMUNICATIONS SHOULD BE ADDRESSED. (202)

THE IMPERIAL IRON TUBE COMPANY,

(SUCCESSORS TO GEORGE B. LLOYD & CO.)
GAS STREET AND BERKLEY STREET,
BIRMINGHAM,
Manufacturers of Wrought Iron Tubes & Fittings,
FOR GAS, STEAM, AND WATER.
PATENT GLASS ENAMELLED AND GALVANIZED TUBES,
AND
LAP-WELDED IRON BOILER TUBES.
(193)

CHADBURN BROTHERS' PATENT METALLIC STEAM GAUGES.



THESE GAUGES have been in use more than three years, and have given general satisfaction. Those first fixed are now in as good working condition as ever. Testimonials, &c., may be seen at CHADBURN BROS.' Works, Sheffield.

The Gauges may be had of Messrs. Elliott Bros., Strand; Mr. Fenn, Newgate-street; Messrs. Dring and Fage, Tooley-street; Messrs. Nigretti and Zambra, Holborn. (286)

HIGH-PRESSURE VALVE-COCKS
LAMBERT'S PATENT.

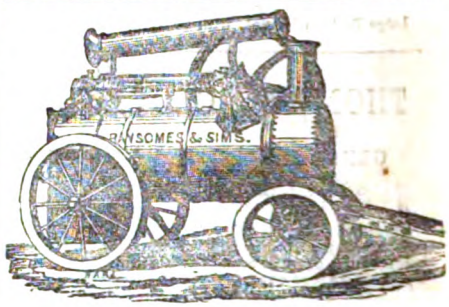
Equilibrium Ball Valve. Cottage Closet Valve.

The Equilibrium Ball-Valve is simple and certain in its action, and is cheaper than the common cocks now in use.

The Cottage Valves are suitable for application to any kind of basin; and, as they shut against the pressure, no concussion in the pipes can possibly occur.

These cocks have been extensively and most successfully used in many towns, under continuous high pressure, varying from 100 to 350 feet; their efficiency and durability is, by experience, established.

THOMAS LAMBERT and SON,
Brass Founders, Short-street, New-cut, Lambeth. (287)



RANSOMES AND SIMS,

IPSWICH,

AGRICULTURAL & GENERAL ENGINEERS

AND

IRONFOUNDERS.

LONDON OFFICE: 31 ESSEX STREET, STRAND, W.C. (265)

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

[EDITED BY R. A. BROOMAN AND E. J. REED.]

(Registered for transmission abroad.)

PRICE, FOURPENCE.
BY POST 5d.

VOL. 2.—NO. 34.
[NEW SERIES.]

LONDON: FRIDAY EVENING, AUGUST 19, 1859.

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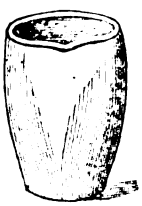

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MUNTZ'S PATENT SOLID ROLLED BRASS AND COPPER TUBES, now extensively used on the principal Home and Foreign Railways, and for Marine Boilers by the Government and leading Steam-Packet Companies, are cheaper and more durable than the ordinary tubes.

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PATENT LEVER BREAKS for RAILWAY WAGGONS, doing away with the objectionable Break Rack. Can be applied to existing stock at a trifling expense. Royalty moderate.

Models can be seen at 34 Great George-street, Westminster, and the Breaks in action at the Works of the Railway Carriage Company at the Peterborough Station, on the Eastern Counties Railway; the Rugby Station, London and North-Western Railway; the Cardiff Docks Station, Taff Vale Railway; and at the Works, Oldbury, near Birmingham, where all communications are requested to be sent. (275)

EDWIN JEWITT, ENGRAVER ON WOOD AND DRAFTSMAN, 1 Pickett-place, Strand, near Temple-bar. Engineering, Scientific, and Mechanical Designs accurately engraved. Manufacturers and Tradesmen's Catalogues Illustrated. W.C. (84)

GREAT REDUCTION IN THE COST OF STEAM POWER.

THE temperature of the products of burnt fuel escaping into the Smoke-boxes of Locomotive and Portable Engines is upwards of 800°. DUNCAN, GWYNNE, and C. WYE WILLIAM'S PATENT HEAT DIFFUSERS, placed in the Tubes, will utilize about 400° of the heat, convert it into an equivalent of working steam, and reduce the temperature to about 350° or 400°.

The Patentees are prepared to accept for Royalty a part of the value of the fuel saved by the use of their simple appliances.

Every information may be had on application to the Manufacturers, GWYNNE & CO., Engineers, Essex-street Wharves, Strand, W.C., London. (251)

TO STEAM SHIP BUILDERS, ENGINEERS, TOOL MAKERS, IRON MASTERS, AND OTHERS.

THE ADVERTISER, who has had considerable experience in Marine Engineering and Iron Shipbuilding, and who is an expert Draughtsman, is desirous of meeting with a permanent Engagement as London Agent, Manager of a Shipbuilding Yard, or to act in any capacity in which ample knowledge of Mechanical Details and a large connexion among Engineers, Ship Owners, and others, might be rendered available. The Advertiser having also been much engaged in working out some important patented inventions, would undertake to further the objects of those having property of this kind, either to dispose of or to bring into operation. Apply by letter, to M. E., MECHANICS' MAGAZINE Office, 166 Fleet-street. (250)

WATER POISONED BY LEADEN PIPES.

"The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight. The water has cut these deep pits almost through the pipe, and not only upon the portion which we have illustrated, but has formed similar chasms throughout the entire length."—*Expositor.*

Poisoned Water Preventable.

BY THE USE OF GUTTA PERCHA TUBING.

The Gutta Percha Company have been favoured with the following letter,

From Dr. MURRAY, Hull.

"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha. Nothing can be better. I have also recommended it to others, who have adopted the expedient.

Resistance of Frost.

The Gutta Percha Company have been favoured with the following Letters in reference to the non-conducting properties of Gutta Percha Tubing, in the resistance of Frost.

From J. ARMSTRONG, Esq., M.D., Gravesend.

"My private house, which was supplied with your Gutta Percha Tubing some five or six years ago, has never required the slightest attention; and previously, there was no winter passed that we were not deluged in consequence of the bursting of the leaden pipes."

From HENRY BROWN and SONS, Western Works, 108 Rockingham-street, Sheffield.

"We have now a positive proof of the frost-resisting properties of the Gutta Percha Piping. On our premises we have a leaden Pipe and a Gutta Percha one lying side by side. The leaden one has been completely frozen up at least ten days, and the Gutta Percha one is still unaffected.

Every Variety of Gutta Percha Article.

SUCH AS

Mill-bands,
Tubing for Watering Gardens, &c., &c.,
Soles,
Sheet,
Pump-buckets,
Fire-buckets,
Bottles,
Bosses,
Union-joints,
Flasks,
Bowls,
Chamber-vessels,
Galvanic Batteries,
Toilet-trays,
Sponge-bags,
Curtain-rings,
Talbotype-trays,
Photographic Baths.
&c., &c.

MANUFACTURED BY THE

GUTTA PERCHA COMPANY,

And Sold by their

WHOLESALE DEALERS IN TOWN AND COUNTRY.

Submarine and Subterranean Telegraph Wires Insulated with Gutta Percha.

The Gutta Percha Company, Patentees,

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(54)

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LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

Designs for Guildhall, and other Public Buildings, *Cambridge.*—At a cost not exceeding £6,000, and £200 for the best design, and £100 for the second best. The designs selected to be the property of the Council. Printed particulars at the office of Mr. C. W. Cooper, Town Clerk, Guildhall, Cambridge. Designs, with mottoes only, to 31st October.

Steam Engine, &c., *Londonderry.*—For a steam-engine and pumping apparatus for Londonderry Graving Dock, conformable to terms to be seen on application to Mr. A. H. Stewart, Clerk to the Harbour Commissioners, Londonderry, or Messrs. D. and T. Stevenson, civil engineers, Edinburgh. Tenders to Mr. Stewart, September 15.

Railway, *North-Eastern.*—For the construction of a branch (about 11¼ miles in length) from the North Yorkshire and Cleveland line to Rosedale, in the North Riding of the County of York. Plans, sections, and specifications, at the Engineer's Office, Central Station, Newcastle, on and after the 1st day of September next. Tenders to J. Cleghorn, York, secretary, marked "Tenders for Rosedale branch," to be sent not later than 9 a.m., September 23rd next.

Grand House, with Cells, &c., *Dover.*—Bill of quantities, on payment of half-a-guinea, at Royal Engineer office, Dover. Tenders to the Director of Contracts, War-office, Pall-mall, London, S.W., to September 5th.

Severing Street, *Crumpsall.*—Plans for the severing of Ireson-street (length 250 yards) of Mr. Bell, surveyor, 51 King-street, Manchester. Tenders to J. Knott, Esq., Overseer's offices, Crescent-road, Crumpsall, to September 10th.

Military Store, *Aldershot.*—Plans, &c., Royal Engineer's office, Aldershot. Surveyor chosen on the 11th. Copy of the bill of quantities required. Tenders, noon, August 29.

Three School Rooms, and Master's Residence, *Pensnett, near Dudley.*—Plans, &c., of the Architect, Mr. W. Bourne, Tower-street, Dudley. Tenders to Churchwardens, August 27th.

To Engineers, Machine-builders, and Others.—One of the directors of the Technical office of St. Petersburg, being now in London, invites engineers and others who can supply machinery, steamboats, rails, railway plant, boiler-plates, &c., agricultural and all other implements, of the most improved make, to deposit their prospectuses and price current, with terms of discount, addressed Mr. Havett, care of Grierson, Tweeddale, and Co., 1A Princes-street, Bank, E.C.

Church, *St. Paul's, Maidstone.*—Drawings at the office of Messrs. Peck and Stephens, High-street, Maidstone. Tenders to Rev. H. W. Dearden, Boxley-road, Maidstone, to August 22.

School-room and Cooking Kitchen, with Latrines for Children, Ablution-room, &c., at *Hilsea Barracks, near Portsmouth, Hants.*—Plans, &c., Royal Engineer Office, Portsmouth. Tenders to Director of Contracts, War-office, Pall-mall, London.

Enlarging Corn Exchange, *Braintree.*—Plans, office of Messrs. Veley and Cannington, solicitors, Braintree. Tenders to Messrs. Beadle, Son, and Chancellor, Chelmsford, August 23rd.

Police Station, *Worksop.*—Plans, &c., at office of Mr. *Goddard, architect*, Lincoln. Tenders to office of Messrs. Brodhurst and Hodding, solicitors, Worksop.

Drains, *Enfield Local Board of Health.*—For the making and constructing of a glazed stoneware pipe-drain from the outfall works of the Board to the new cut and sewer of the East London Water Works Company at Ponder's End, on the east side of the Eastern Counties Railway. *Plans and specifications* at the office of the Board in Enfield town, up to August 25, when and where tenders.

Church, *Ireland.*—For repairing the Church of Dungarvon, County Kilkenny. The specifications to be seen in the hands of the resident minister of the parish. Tenders to the Ecclesiastical Commissioners of Ireland.

Tin-platers' Wares.—For supplying Her Majesty's Dockyards with tin-platers' wares, under a contract for 12 months certain. Patterns, form of tender, schedule, and conditions, at Somerset-place. Tenders, September 6th.

Inspector of Steam Boilers, *For the Steam Boiler Assurance Company.*—Must have a thorough practical knowledge of the construction of steam-boilers and engines, and experience in indicating and in mechanical drawing. Apply by letter to Mr. R. B. Longridge, No. 1 New Brown-street, Manchester.

Engineer's Foreman.—One who thoroughly understands working drawings, to superintend the making of switches and crossings, turntables, &c., in an engineering establishment. State wages required, and where last employed. P. 18, of the Printer of the *Manchester Guardian.*

Turners and Fitters.—Wanted, two really first-class, accustomed to general engine and piston work. Address, stating age, experience, and wages. X. Y., Post-office, Openshaw, Manchester.

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GAS STREET AND BERKLEY STREET,

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Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES. (193)

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Owing to the increase in the business of this Company, it has removed to more commodious offices at 71 Fleet-street, E.C., where in future the Company will carry on every description of business connected with Patents and Inventions, in the disposal and working of which the Directors are enabled to offer unusual and economical facilities in consequence of their having agents in every large town.

The Company's Engineer, Mr. C. W. Orford, C. and M. E., attends at the offices every Tuesday and Friday, for the purpose of advising with applicants on their Inventions. Special appointments can be made for any day. Applications to be addressed to

ROBERT M. LATHAM, Esq.,
Secretary,
71 FLEET STREET, E.C.

Office hours 10 to 4. Saturdays, 10 to 2.
*** Applications for shares still received. (230)

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LOCOMOTIVE TYRE-BARS of every description for Engines, Carriages, and Railway Waggon Wheels.
STEEL-IRON for Springs. MERCHANT and other Irons manufactured. WM. F. HOYLE, Proprietor. (278

TO SHIPBUILDERS.

IRON SHIPS may be rendered FIRE-PROOF if internally fitted with Fibrous Slab in lieu of Deal.

Extract from a letter of the Captain of the Royal Bride Steamer, trading between Bristol and Melbourne:—"25th May, 1859.—From my experience of the last nine months in all climates, I have no hesitation in saying there is no kind of lining I know of equal to your Fibrous Slab for Iron Ships.—Yours, &c. (Signed), Alex. Newland."

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TO ENGINEERS, ARCHITECTS, PATENT AGENTS, &c.

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E.C.—C. M. and Co.'s only Establishments. (139

WATER GAUGES—WATER GAUGES.—Sir,—We find your German Gauge Tube superior to any other, and strongly recommend it. We were compelled to abandon the use of our water gauge until applying your glass tube.
Wilcox and Co., Millwall Pottery Company.

These Tubes are superior to all others; being a clear white, no mistake can arise in working. Guaranteed to stand a pressure of 500 lb.

Extensively used on all the principal lines.

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*** Price List of Gauge Fittings, &c., on application. (98)

PATENT WEDGE and GROOVED SURFACE FRICTIONAL GEARING.—The PATENT FRICTIONAL GEARING COMPANY, Proprietors of ROBERTSON'S WEDGE SURFACE FRICTIONAL GEARING PATENTS, grant Licences to Users of Machinery, for the unlimited use of the System in their Works, on very moderate terms, enabling them to make or order from any Mechanician the Machinery they require.

The Company possess Five Patents relating to this Frictional System, including (in addition to their Bevel and Mitre Wheels) a System of Disc Clutches and Clutch Movements, Wheel Clutching, Reversing, Differential, Speed Ring, Varying Speed, and Break Movements, and of Shafting, Pillow Blocks, Shafting Hangers, &c.

Frictional Wheels thus formed are applicable to the heaviest as well as the lightest kind of work, and, in addition to their being extensively in use for ordinary gearing purposes, have been in use for a considerable time applied to Mills for Rolling Iron, the Screw-Propeller, Incline-Winding Engines, Saw Mills, Pumping Engines, Flax Scutchers, Fan Blowers, Calico-Printing Machinery, Steam Winches, Cranes, Hoists, &c.

This system gives great facilities for simplifying Machines, and for mechanical combination, and has the advantage of being noiseless and cleanly, there being no oil or grease used on the wheels. Wheel Catalogues and Circulars, giving particulars, sent free by Post; also, a list of manufacturing Agents, and information regarding those who, from locality or experience, are best able to execute orders for the description of work required.

Office, 20 Buchanan-street, Glasgow 146)

FOR CORRECT FAMILY ARMS, CREST, or PEDIGREE, send name and county and 7s. 6d. to J. LOCK'S, City Heraldic Office, No. 2, Old Jewry, E.C., London, and in a few days you will receive a neat drawing of your Arms, &c., in Heraldic Colours, to be engraved on Seal, Ring, or Family Plate. On y parle Français, Italien, Allemand, et Hollandais.

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MALLET'S PATENT BUCKLED PLATES.—MR. ROBERT MALLET, C.E., Inventor and Patentee of these Plates (now being laid for the Floor of the New Bridge, Westminster, and applicable to Bridge, Wharf, and Fire-proof flooring, and to a variety of other important purposes) gives notice that he has withdrawn from this date all Licences whatsoever to manufacture or vend his Patent Plates, and taken the management of the Patent exclusively into his own hands. Applications for the Plates to be made to the Patentee, who has arranged for their prompt supply, at his offices, 11 Bridge-street, Westminster, S.W., and 97 Capel-street, Dublin. (264)
18th May, 1859.

RICHARD BAIRD, GENERAL COMMISSION AGENT, and CONTRACTOR for all descriptions of RAILWAY PLANT and STORES.
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FOR DRIVING MACHINERY, MILLS, &c.—INDIA-RUBBER BANDS, improved make, to resist moist and dry heat, of any length, width, and thickness. Prices and instructions for use on application.
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Vulcanised India-Rubber Works, Goswell-mews, and
8 Goswell-road, London, E.C. (256)

CAUTION.

TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine
SMITH'S PATENT DOOR SPRINGS,
For Swing Doors, are stamped with Name and Address, thus—
SMITH, PATENTEE, 69 PRINCES STREET, LEICESTER SQUARE, LONDON,
and that Springs thus marked are warranted.
SMITH'S PATENT WEATHER-TIGHT CASEMENT FASTENING AND SILL-BARS
are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. (195)

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LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

Beg respectfully to call attention to their

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THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit for market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel may be stated as follows:

1st. Their compactness; being fully one-third less in size and bulk than the ordinary Machines hitherto in use for the same purpose.

2nd. The great reduction in the number of wearing parts. In these Improved Machines more than one-half the spindles, pulleys, bearings, and driving belts required for the ordinary Machines are dispensed with.

3rd. The novel arrangement by which the Dressing Apparatus is instantly varied, while the Machine is at work, to suit all kinds and conditions of grain.

4th. The very important saving in the cost of keeping the Machines in working order, consequent on the great reduction in the number of wearing parts.

N.B.—Catalogues in English, French, or German can be obtained FREE, on application being made to R. G. & SONS, at LEISTON WORKS, SAXMUNDHAM, SUFFOLK. (314)

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GREAT DOVER-STREET AND SWAN-STREET, BOROUGH, LONDON, S.E.

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SUPERIOR LEATHER MILL BANDS,

WELL STRETCHED AND PURE OAK BARK TANNED.

SINGLE BANDS.			DOUBLE BANDS.			EDGE BANDS.		
	s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
1 inch, per foot,	0 3 to 0	4	3 inch., per foot	2 2 to 2	6	3 inch., per foot,	2 0 to 2	2
1½ " "	0 5 — 0	6	4 " "	3 0 — 3	4	3½ " "	2 4 — 2	9
2 " "	0 7 — 0	8	5 " "	3 9 — 4	1	4 " "	2 10 — 3	2
2½ " "	0 9 — 0	10	6 " "	4 6 — 4	10	4½ " "	3 0 — 3	3
3 " "	1 0 — 1	2	7 " "	5 4 — 5	10	5 " "	3 4 — 3	8
4 " "	1 6 — 1	8	8 " "	6 6 — 7	0	5½ " "	3 6 — 3	9
5 " "	1 10 — 2	1	9 " "	7 6 — 8	0	6 " "	3 9 — 4	3
6 " "	2 4 — 2	7	10 " "	8 6 — 9	0	6½ " "	4 1 — 4	4
7 " "	2 10 — 3	2	" "	" " — "	"	7 " "	4 4 — 4	10
8 " "	3 4 — 3	8	" "	" " — "	"	8 " "	4 6 — 5	6

N.B.—These Bands are celebrated for being well stitched and riveted at joints, and being also of equal thickness throughout.

H. & SONS beg to call particular attention to their having always on hand a Large Assortment of Improved Screw-socket Rivets, varying in size, from ¼-inch upwards, for fastening Mill Bands, Elevator Cups, &c., also White and Brown Laces. (206)

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RAILWAY, SHIP, AND BUILDERS' IRONWORK OF ALL KINDS.

Roofs and Bodies of Luggage Vans, Trucks, and Coal Waggons.
Cast and Wrought Iron Columns, Stanchions, and Girders.
Ties, Straps, King-heads, Shoes, &c.
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Rick Stands, and Sliding Roofs of Wrought Iron.

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The application of Corrugated Iron Roofing Plates to Roofs of Timber Framing, particularly suitable for the Colonies, Railway Carriage Sheds, and Station Roofs; Iron Sheds for Sugar and Coffee Estates, for Manufactories, Weaving Sheds, &c.; Iron Roofs for Churches, Farm Buildings, Gasworks, &c.

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PATENT GRASS SEED SEPARATOR,

which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

PERENNIAL AND ITALIAN RYE-GRASS, &c.,

AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

These Machines were admittedly the most novel, and, at the same time, the most useful and important to the Farmer of any exhibited at the late SMITHFIELD CLUB SHOW.

They may be seen at work at the Establishment of the Manufacturer,

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Communications to be sent to the Patentee, J. SCOTT, 111 Drummond Street, Euston Square London, N.W. 4

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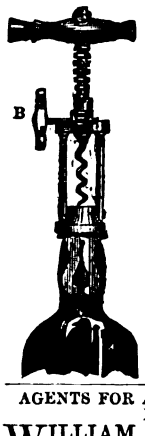
MATHEMATICAL DRAWING INSTRUMENTS, RULES, TAPES, CHAINS, LEVELS, THEODOLITES, BOX SEXTANTS, PRISMATIC and POCKET COMPASSES. Price Lists of the above articles sent post free, by JOHN ARCHBUTT, 20 Westminster Bridge Road, Lambeth, near Astley's Theatre. Every article warranted, and the prices will be found considerably lower than ever before charged for articles of similar quality. Routledge's Engineers' Slide Rules, 4s. 6d. each; Hawthorn's ditto, 5s. 6d.; Carpenters' Rules from 1s. (148)



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LONDON RACK CORK

SCREWS

on the neck of a bottle, and it is ready for use. Some of these Cork Screws are fitted with Patent Spring Lugs to embrace the neck of the bottle, and so direct the worm through the centre of the cork.

Sold by the Patentee at 56 and 57 Cornhill, and 23 and 24 Fleet-street, London; and may be had at all Cutlers' and Ironmongers'. (301)

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Address H., MECHANICS' MAGAZINE Office, 166 Fleet-street, where a Drawing may be seen. (317)

BIRMINGHAM WAGGON COMPANY (LIMITED) has RAILWAY WAGGONS for HIRE. Apply to the Secretary, 3 Newhall-street, Birmingham. (318)

WILLIAM WARNE & CO.,

Manufacturers of all descriptions of

VULCANIZED INDIA-RUBBER

SHEETS, WASHERS,

HOSE-PIPES, TUBINGS, ETC.;

Sole Manufacturers of

WARNE'S PATENT INDIA-RUBBER TUBULAR MATS,

For Doorways, Stairs, Baths, Carriages, Ships, &c., which never clog, require no beating, and, unlike all other Mats, are readily cleansed by water. Indestructible by decay, these Mats are especially suitable for uncovered Passages and out of door purposes. Seat Mats, Housemaids' Mats, and Brushes for wooden and stone floors.

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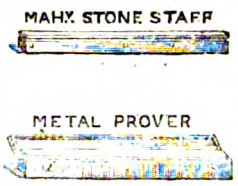

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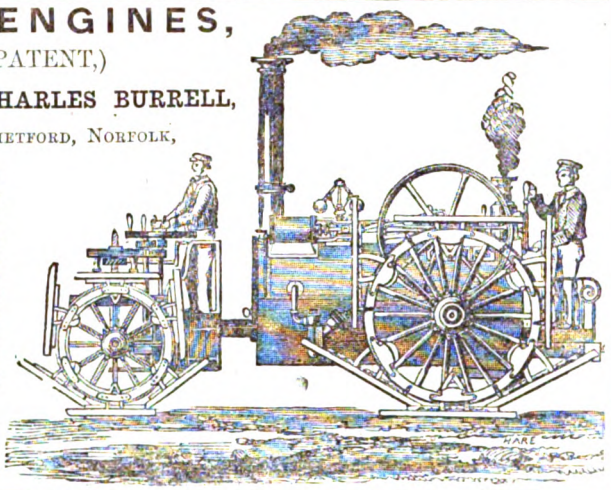

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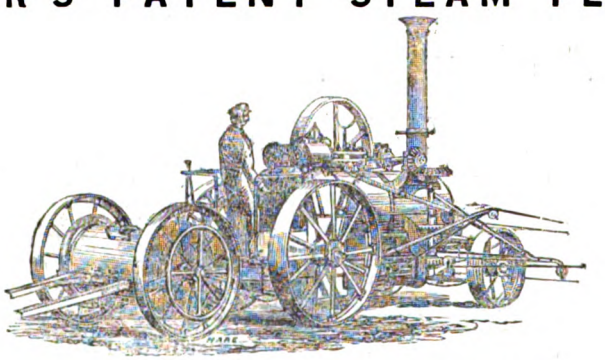

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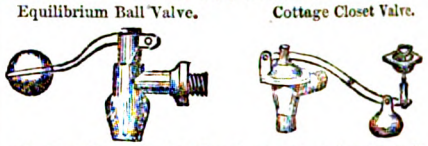

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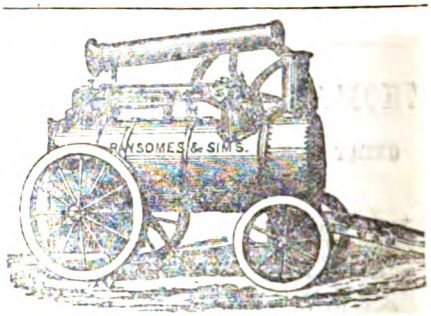

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

PRICE, FOURPENCE. By Post 5d.

LONDON: FRIDAY EVENING, AUGUST 26, 1859.

VOL. 2.—NO. 35. [NEW SERIES.]

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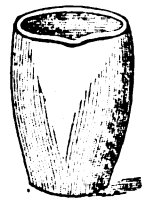

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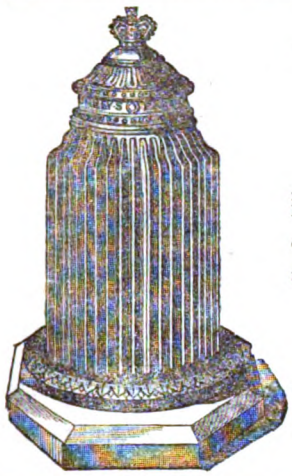

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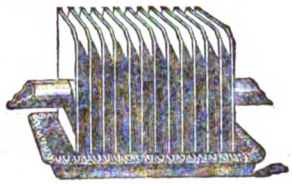

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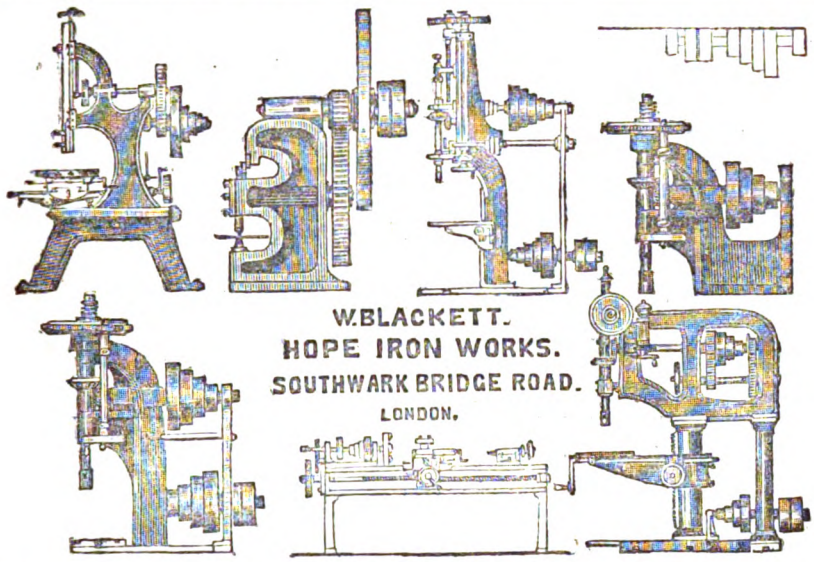

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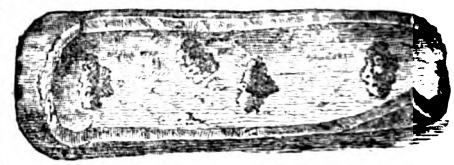

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"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha Tubing. Nothing can be better. I have also recommended it to others, who have adopted the expedient."

A variety of Gutta Percha Articles, such as Mill Bands, Tubing, Sheet, Soles, Pump Buckets, Bosses, Union Joints, Bottles, Bowls, Flasks, Curtain and Cornice Rings, Solid Frames, Galvanic Batteries, &c., &c.

MANUFACTURED BY THE

Gutta Percha Company, Patentees,

18 Wharf Road, City Road, London,

AND SOLD BY THEIR

WHOLESALE DEALERS IN TOWN AND COUNTRY (30)

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PRICES CURRENT OF METALS.
London, 26th August, 1859.

	£ s. d.	£ s. d.	Dis. p. ct
IRON, Rails in Wales and N. of England ..... pr. ton	6 0 0	to 6 5 0	nett
Welsh Bars, in Wales .. "	5 17 6	" 6 2 6	3½
Staf. Bars at the Works "	7 5 0	" 7 15 0	2½
" Hoops ..... "	8 5 0	" 8 15 0	"
" Sheets, Singles .... "	8 15 0	" 9 5 0	"
" Nail Rods ..... "	7 5 0	" 7 15 0	"
" Boiler Plates .... "	8 10 0	" 9 5 0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow..... "	2 12 6	" 2 12 9	nett
Do. No. 1, Good Brands "	2 13 3	" 2 15 0	"
Scotch Bars ..... "	7 5 0	" 8 0 0	"
Swedish Bars, in London "	13 10 0	" 15 0 0	2½
COPPER, Sheet and Sheathing per lb.	0 0 12		3½
Tough Cake and Tile " ton	107 10 0		"
Best Selected..... "	110 10 0		"
Australian ..... "	110 10 0	" 111 0 0	"
South American .... "	103 0		"
Yellow Metal Sheathing..... per lb.	0 0 10		"
STEEL, Swedish Keg ..... pr. ton	19 0	" 19 0 0	2½
" Faggot ..... "	21 0 0	" 21 0 0	"
TIN, English, Block ..... pr. cwt.	6 16 0		2½
" Bar..... "	6 17 0		"
Foreign, Banca ..... "	7 3 0		nett
" Straits..... "	6 19 0		"
TINPLATES, Charcoal, I.C. .. pr. box	1 13 0	" 1 14 0	5
" Coke, I.C. ..... "	1 7 0	" 1 8 0	"
LEAD, Pig, English ..... pr. ton	22 15 0	" 23 5 0	2½
" Spanish ..... "	22 0 0	" 22 10 0	"
" Sheet ..... "	23 15 0	" 24 0 0	"
SPELTER, on the spot ..... pr. ton	21 10 0	21 15 0	net.
" for arrival..... "	21 15		"
ZINC, English, Sheet ..... "	26 0		14
QUICKSILVER ..... per btl.	7 0 0		14

Prices of all sorts of metal are steady, with a very limited amount of business doing.

LAWRIE AND HAGGER, Metal Brokers.
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VINEGAR.—Patronised by Her Majesty's Government.

CONDY'S PATENT PURE CONCENTRATED MALT VINEGAR.

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Also Manufactory for Captain John Grant's much improved Cooking Apparatus. (44)

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Are prepared to ESTIMATE FOR and CONSTRUCT BRIDGES, PIERS, JETTIES, &c., in Iron, Wood, or Stone. Also to supply Cranes, Girders, Turntables, and Railway Work and Plant generally. (199)

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LOCOMOTIVE TYRE-BARS of every description for Engines, Carriages, and Railway Wagon Wheels.
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TO SHIPBUILDERS.
IRON SHIPS may be rendered FIRE-PROOF if internally fitted with Fibrous Slab in lieu of Deal.
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MEDALS AWARDED TO
THOMAS GLOVER'S PATENT DRY GAS-METERS.
VIZ.:
GREAT EXHIBITION, LONDON, 1851. | NEW YORK EXHIBITION, 1853.
AND PARIS UNIVERSAL EXHIBITION, 1855.

LONDON, March 25, 1859.

THOMAS GLOVER takes this opportunity of thanking Gas Companies and his other Customers for the very liberal support and patronage he has received during the past year, which has far exceeded his most sanguine anticipations, having sold a greater number of his PATENT DRY GAS-METERS since the dissolution of his partnership with Mr. Croll than he was ever previously enabled to do in any one year.

THOMAS GLOVER confines his sole attention to the business of Gas-Meter Making. The propriety of his doing so is satisfactorily proved by his success; and, without the practice of any quackery, or any attempt to delude the public by an absurd exhibition of "Old and New Valves," his Meters are in general use by the Metropolitan Gas and other Companies in this Country and abroad. For example, one Metropolitan Company have now in use above 12,500 of his Patent Dry Gas-Meters; some of these Meters have been fixed for Fourteen Years, and are still in working order, without complaint from either the Company or the Consumer.

THOMAS GLOVER thinks it necessary to put Gas Companies on their guard against parties selling Patent Dry Gas-Meters constructed in imitation of his, but unskilfully made on erroneous principles, and with improper and unsuitable materials.

THOMAS GLOVER'S Workshops are now the most extensive in this or any other country, and he is thereby enabled promptly to execute orders to any extent required. Purchasers may at any time inspect his Works and the Materials of which his Meters are constructed. He is ready to enter into Contracts with Gas Companies and others to uphold their Stock of his Meters for Twenty Years at an annual charge varying from 2½ to 5 per cent., and to leave always in the hands of Gas Companies Three Years' charge for upholding, as a guarantee for the fulfilment of the Contract.

THOMAS GLOVER,
PATENT DRY GAS-METER MANUFACTURER,
SUFFOLK STREET, CLERKENWELL GREEN, AND
ALLEN STREET, GOSWELL STREET, E.C. (293)

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Not only Deodorizes but Disinfects perfectly, and DESTROYS FOR EVER the cause of infection.
Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.
This fluid has been examined and reported upon by the Board of Health, all the most eminent Men and Chemists of the day, in all cases in the most satisfactory manner possible.
The Public are recommended to use this Fluid, properly diluted with water, frequently and habitually in larders, sculleries, dairies, musty cakes, sick rooms, close places, &c., as it has numerous advantages, and can be used with certain immediate success and perfect safety.
Sold in Quart Bottles, 4s.; Pints, 2s.; Half-pints, 1s.; and in bulk, 10s. per Gallon.
Free to Railway on receipt of Order or Stamps. (238

WATER GAUGES—WATER GAUGES.—Sir,—We find your German Gauge Tube superior to any other, and strongly recommend it. We were compelled to abandon the use of our water gauge until applying your glass tube.
WILCOX and Co., Millwall Pottery Company.
These Tubes are superior to all others; being a clear white, no mistake can arise in working. Guaranteed to stand a pressure of 500 lb.
Extensively used on all the principal lines.
To be had only of E. MOORE, 55 Upper Marylebone-street, W.; and 72 Great Titchfield-street, W.
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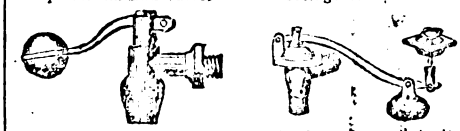
HIGH-PRESSURE VALVE-COCKS
LAMBERT'S PATENT.
Equilibrium Ball Valve. Cottage Closet Valve.



The Equilibrium Ball-Valve is simple and certain in its action, and is cheaper than the common cocks now in use.
The Cottage Valves are suitable for application to any kind of basin; and, as they shut against the pressure, no concussion in the pipes can possibly occur.
These cocks have been extensively and most successfully used in many towns, under continuous high pressure, varying from 100 to 350 feet; their efficiency and durability is, by experience, established.
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Suitable for testing the speed of all classes of machinery.

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Which will be found both Simple and Efficient for the Distillation of Fresh from Salt Water.

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Made to act when placed either above or below the water level. These Closets are simple, efficient, and mechanically arranged for their various requirements, and are not liable to derangement.

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They keep a Large Stock of Goods, of their own Manufacture and from the Best Makers, constantly on view; so that by a visit to their Works or Depôt, much valuable time may be saved by Managers, Engineers, and other Gentlemen who may require such Stores, together with a further saving in the cost of the Articles.

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RICHARD GARRETT AND SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

Beg respectfully to call attention to their

NEWLY-INVENTED "FIXED" AND "PORTABLE" COMBINED FINISHING, THRASHING, AND DRESSING MACHINES.

THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit for market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel may be stated as follows:

1st. Their compactness; being fully one-third less in size and bulk than the ordinary Machines hitherto in use for the same purpose.

2nd. The great reduction in the number of wearing parts. In these Improved Machines more than one-half the spindles, pulleys, bearings, and driving belts required for the ordinary Machines are dispensed with.

3rd. The novel arrangement by which the Dressing Apparatus is instantly varied, while the Machine is at work, to suit all kinds and conditions of grain.

4th. The very important saving in the cost of keeping the Machines in working order, consequent on the great reduction in the number of wearing parts.

N.B.—Catalogues in English, French, or German can be obtained FREE, on application being made to R. G. & SONS, at LEISTON WORKS, SAXMUNDHAM, SUFFOLK. (314)

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SUPERIOR LEATHER MILL BANDS,

WELL STRETCHED AND PURE OAK BARK TANNED.

SINGLE BANDS.

	s.	d.		s.	d.
1 inch, per foot,	0	3	to 0	4	
1½ " "	0	5	— 0	6	
2 " "	0	7	— 0	8	
2½ " "	0	9	— 0	10	
3 " "	1	0	— 1	2	
4 " "	1	6	— 1	8	
5 " "	1	10	— 2	1	
6 " "	2	4	— 2	7	
7 " "	2	10	— 3	2	
8 " "	3	4	— 3	8	

DOUBLE BANDS.

	s.	d.		s.	d.
3 inch., per foot	2	2	to 2	6	
4 " "	3	0	— 3	4	
5 " "	3	9	— 4	1	
6 " "	4	6	— 4	10	
7 " "	5	4	— 5	10	
8 " "	6	6	— 7	0	
9 " "	7	6	— 8	0	
10 " "	8	6	— 9	0	
" " "	"	"	— "	"	
" " "	"	"	— "	"	

EDGE BANDS.

	s.	d.		s.	d.
3 inch., per foot,	2	0	to 2	2	
3½ " "	2	4	— 2	9	
4 " "	2	10	— 3	2	
4½ " "	3	0	— 3	8	
5 " "	3	4	— 3	8	
5½ " "	3	6	— 3	9	
6 " "	3	9	— 4	3	
6½ " "	4	1	— 4	4	
7 " "	4	4	— 4	10	
8 " "	4	6	— 5	6	

N.B.—These Bands are celebrated for being well stitched and rivetted at joints, and being also of equal thickness throughout.

H. & SONS beg to call particular attention to their having always on hand a Large Assortment of Improved Screw-socket Rivets, varying in size, from ⅛-inch upwards, for fastening Mill Bands, Elevator Cups, &c., also White and Brown Laces. (206)

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IRON BUILDING AND ROOFING WORKS,

GAS STREET, BIRMINGHAM.

RAILWAY, SHIP, AND BUILDERS' IRONWORK OF ALL KINDS.

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Iron Punts for Sugar Estates, &c., &c.
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Rick Stands, and Sliding Roofs of Wrought Iron.

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Plans and Estimates will be furnished on Application.

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PATENT GRASS SEED SEPARATOR,

which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

PERENNIAL AND ITALIAN RYE-GRASS, &c.,

AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

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NOTE.—Descriptive Catalogues of any particular class of Implements forwarded post free upon application. (318)

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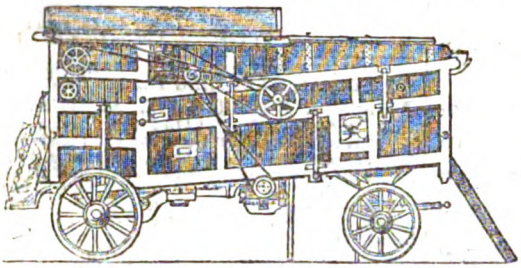

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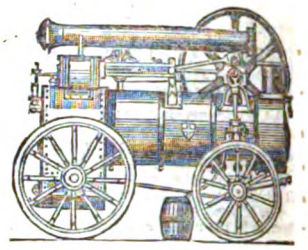
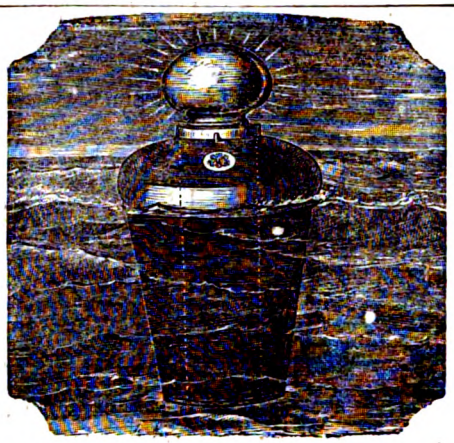
(34)



GRESHAM'S RECORD PATENT BUOY.



The RECORD BUOY is intended to be kept in some place available for instant use, and to be thrown overboard from a sinking ship, or a Vessel on Fire, so as to intimate disaster, having a paper inserted therein, already filled up with the Ship's Name, Port of Registry, Official Number, &c., and a few last words hastily written, intimating the nature of the calamity, with any further information that can be given at such a time. It has capacity and buoyancy to contain besides these, the Log Book, and several pounds' weight of Papers or Valuables. It is lined with Cork between the Cylinder and outside case, so that, although waterlogged, it will not sink, but keep afloat for a long time, probably for years.

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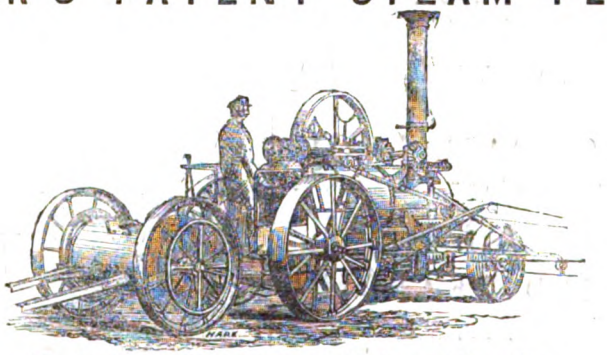

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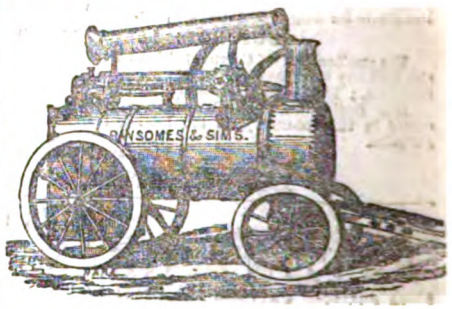

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AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

[EDITED BY R. A. BROOMAN AND R. J. REED.]

(Registered for transmission abroad.)

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VOL. 2.—NO. 36. [NEW SERIES.]

LONDON: FRIDAY EVENING, SEPTEMBER 2, 1859.

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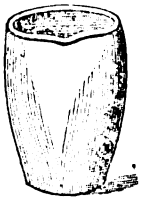

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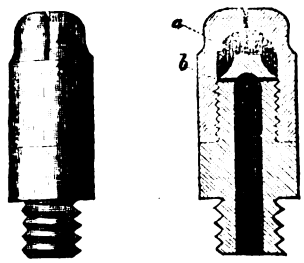

ENLARGED VIEWS OF BURNER.

a Chamber for gas before passing through ordinary slit in caps of Burner.
b Lateral openings for filling the chamber *a*, their direction being at an angle with or across the opening in cap of burner.

THE Patentees have great pleasnre in introducing the ECONOMIC GAS BURNER to the notice of the gas consuming public, and feel confident it will be found to possess advantages that cannot be claimed for any other gas burner in present use. This invention may also be called an Anti-pressure Gas Burner, being found to resist a pressure varying from 1¼ in. to 2½ in., and giving a light more than double that of the common tulip burner with the same consumption of gas.

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Messrs. Oldfield and Dixon, Saltaire, June 14th, 1859.

Gentlemen—We have now a considerable number of your Patent Gas Burners in use, and believe there is a great saving over the old burners, but to what extent we cannot say.—We are, gentlemen, yours truly
TITUS SALT, SONS, & Co.

Messrs. Oldfield and Dixon, Low Mill, Keighley, June 16th, 1859.

Gentlemen—We have great pleasure in being able to speak very favourably of your Patent Gas Burners, and think the following statement will sufficiently prove an economy in the consumption of gas. About the 20th December last, we placed your No. 2 burners in the shed, and No. 1 burners in the upper rooms of the mill, where the gas had attained a little extra pressure. Previous to the above date we were making gas from five retorts, but since we have been able to dispense with the use of two. We would add that though this gives evidence of a great saving, an equal recommendation rests in the fact of the light produced being of a superior brilliancy and softness.—Yours very respectfully,
J. & J. CRAVEN & Co.

Messrs. Oldfield and Dixon, Primrose Mill, Embsay, near Skipton, June 20th, 1859.

Gentlemen—We are glad to report favourably of your Patent Gas Burner, but regret we cannot give you a fair statement of the saving per cent., as we had them put on irregularly some weeks after we had begun to light up. We have usually consumed forty tons of coal for gas; this season we have from six to seven tons on hand, and have made the gas required with one retort—previously we were compelled to use two. We consider the brilliancy of the light and the purity of the atmosphere, through the gas being properly consumed, an attainment quite equal to the economy in fuel.—We are, gentlemen, yours respectfully,
ROBINSON & WILKINSON.

Messrs. Oldfield and Dixon, Carleton, near Skipton, July 8th, 1859.

Gentlemen—We applied your Patent Gas Burner to all our lights in the beginning of last winter; it gave us great satisfaction, and we calculate the saving of gas about 20 per cent., besides a much superior light to the old burner.—Yours respectfully,
WM. & JNO. SLINGSBY.

Messrs. Oldfield and Dixon, Fullage Mill, Burnley, July 12th, 1859.

Gentlemen—You have succeeded in inventing an ingeniously contrived Gas Burner, to the illuminating and economising efficiency of which we have pleasure in adding our testimony.—Yours very truly,
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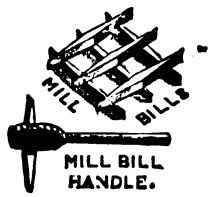

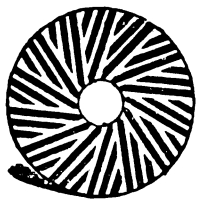

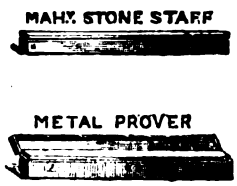

OF HALF A CENTURY.

HUGHES AND SONS, MILLSTONE MAKERS,

Great Dover-street and Swan-street, Borough, London, S.E.,

BEG to call the attention of Millers, Millwrights, Engineers, Agricultural Machinists, Cement Manufacturers, Distillers, Merchants, and others, to their extensive Stock of FRENCH BURR MILLSTONES, manufactured from a superior Brown Burr, of quality, workmanship, and finish not to be equalled by any house in England. Also to their Stock of French Burrs of various quality and texture, selected by them in person at the best quarries in France, where their choice is unlimited. The extent of their business requiring several thousand Burr Stones annually more than any other Millstone Maker in England (as may be seen by reference to the Custom House "Shipping List"), places them in a position to execute all orders entrusted to them to satisfaction.

H. and S. are also Importers of Peak, Cologne, Granite, and Grindstones direct from the quarries; and have always on hand at their works a varied assortment of Flour Machines, Smut Machines, Bolting Machines, Separators, Kilns, &c.; Wove Wire for Screen Work; Wire Webb for Flour Cylinders; Improved Square Smut Wire, wove by machinery, with rough surface, made to cover any size cylinder in one sheet; Bolting Cloths; Best Oak-tanned Leather Millbands, well stretched and riveted at joints; Webbing for Elevators; Elevating Buckets; Screw Jacks, Proved-iron Hoisting Chain; Iron and Brass Sheave Blocks; Iron and Slate Provers; Mahogany Staffs; Sack and Heaving Barrows; Cast Steel Mill Bills, of finest Silver Steel; Flour Machine Brushes, made of the best Russian Bristles; and all other articles used in Mills.

HUGHES and SONS employ none but the best Workmen;

and wish to draw attention to the fact that by employing no Travellers, thereby avoiding the necessarily high expenses connected therewith, they are ina position to give their Customers all the advantages from this circumstance, as well as those arising from adequate capital, combined with practical judgment.

*** ALL GOODS DELIVERED FREE TO WHARVES OR RAILWAYS IN LONDON. (240)

MEDALS AWARDED TO
THOMAS GLOVER'S PATENT DRY GAS-METERS.

VIZ.:

GREAT EXHIBITION, LONDON, 1851. | NEW YORK EXHIBITION, 1855.
AND PARIS UNIVERSAL EXHIBITION, 1855.

LONDON, March 25, 1859.

THOMAS GLOVER takes this opportunity of thanking Gas Companies and his other Customers for the very liberal support and patronage he has received during the past year, which has far exceeded his most sanguine anticipations, having sold a greater number of his PATENT DRY GAS-METERS since the dissolution of his partnership with Mr. Croll than he was ever previously enabled to do in any one year.

THOMAS GLOVER confines his sole attention to the business of Gas-Meter Making. The propriety of his doing so is satisfactorily proved by his success; and, without the practice of any quackery, or any attempt to delude the public by an absurd exhibition of "Old and New Valves," his Meters are in general use by the Metropolitan Gas and other Companies in this Country and abroad. For example, one Metropolitan Company have now in use above **12,500** of his Patent Dry Gas-Meters; some of these Meters have been fixed for Fourteen Years, and are still in working order, without complaint from either the Company or the Consumer.

THOMAS GLOVER thinks it necessary to put Gas Companies on their guard against parties selling Patent Dry Gas-Meters constructed in imitation of his, but unskilfully made on erroneous principles, and with improper and unsuitable materials.

THOMAS GLOVER'S Workshops are now the most extensive in this or any other country, and he is thereby enabled promptly to execute orders to any extent required. Purchasers may at any time inspect his Works and the Materials of which his Meters are constructed. He is ready to enter into Contracts with Gas Companies and others to uphold their Stock of his Meters for Twenty Years at an annual charge varying from 2½ to 5 per cent., and to leave always in the hands of Gas Companies Three Years' charge for upholding, as a guarantee for the fulfilment of the Contract.

THOMAS GLOVER,
PATENT DRY GAS-METER MANUFACTURER,

SUFFOLK STREET, CLERKENWELL GREEN, AND
ALLEN STREET, GOSWELL STREET, E.C. (293)

JOHN HENDERSON PORTER,
ENGINEER AND CONTRACTOR,

PATENTEE OF VARIOUS IMPROVEMENTS IN THE CONSTRUCTION OF

IRON BUILDINGS, BRIDGES, ROOFS, AND FLOORS,

IRON BUILDING AND ROOFING WORKS,
GAS STREET, BIRMINGHAM.

RAILWAY, SHIP, AND BUILDERS' IRONWORK OF ALL KINDS.

Roofs and Bodies of Luggage Vans, Trucks, and Coal Waggons.
Cast and Wrought Iron Columns, Stanchions, and Girders.
Ties, Straps, King-heads, Shoes, &c.
Iron Punts for Sugar Estates, &c., &c.
Tanks, Casks, and Barrels.
Iron Wheelbarrows, Cart Bodies, &c.
Hay Racks, Mangers, Sheep Cribs, and Cattle Troughs.
Rick Stands, and Sliding Roofs of Wrought Iron.

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The application of Corrugated Iron Roofing Plates to Roofs of Timber Framing, particularly suitable for the Colonies, Railway Carriage Sheds, and Station Roofs; Iron Sheds for Sugar and Coffee Estates, for Manufactories, Weaving Sheds, &c.; Iron Roofs for Churches, Farm Buildings, Gasworks, &c.

Iron Buildings, viz.—Warehouses, Sugar Refineries, Market Houses, Railway Stations, Stores, Dwellings, &c., erected in this country, in the East and West Indies, Egypt, China, the Cape of Good Hope, South America, and Australia.

Plans and Estimates will be furnished on Application.

LONDON OFFICE—33 NICHOLAS LANE, CITY, E.C. (272)

TO MANUFACTURERS, THE ENGINEERING, MECHANICAL, & BUILDING TRADES GENERALLY.

MESSRS. BOOTH & CO., AUCTIONEERS and BUILDERS' SALESMEN, having opened Registers for Public and Private Sales of all kinds of JOB LOTS, Surplus Stock, Stores, Tools, Implements, &c., &c., (either Old or New,) beg to call the attention of all parties to the only medium established of the kind, and to state that they are prepared to receive consignments of any weight, bulk, or value, and of any class of Goods for immediate Sale. Full particulars may be had for two stamps, at the BUILDING TRADES REGISTRY OFFICES, (established 1857,) 13 EASTCHEAP, LONDON, E.C. The Public Sales by Auction are held Weekly, on EVERY TUESDAY, at ONE O'CLOCK, and for the present at the BUILDERS' SALE GROUNDS, (established 1858,) 23 and 24 MARYLEBONE ROAD, REGENT'S PARK, W. Catalogues by Post for One Stamp. Advances on New Goods. All communications are held private and confidential. (204)

CAUTION.

TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine

SMITH'S PATENT DOOR SPRINGS,

For Swing Doors, are stamped with Name and Address thus—

SMITH, PATENTEE, 69 PRINCES STREET, LEICESTER SQUARE, LONDON,

and that Springs thus marked are warranted.

SMITH'S PATENT WEATHER-TIGHT CASED FASTENING AND SILL-BARS

are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. 193

TO ENGINEERS & MANUFACTURERS.—INDIA-RUBBER WASHERS, Valves, Engine Packing, Fire-engine and Factory Hose-pipes, Gas Tubing, &c.

JAMES LYNE HANCOCK,
Vulcanized India-Rubber Works, Goswell-mews, and 8 Goswell-road, London, E.C. (258)

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For Particulars, Specimens, Illustrations, and Agencies, apply to Mr. Frederick Ransome, Whitehall Wharf, Cannon-row, Westminster; or Patent Stone Works, Ipswich. A Liberal Discount allowed to the Trade or to Shippers. (173)

NO ADJUSTMENT REQUIRED.—You have only to place one of

LUND'S

LONDON RACK CORK SCREWS

on the neck of a bottle, and it is ready for use. Some of these Cork Screws are fitted with Patent Spring Ends to embrace the neck of the bottle, and so direct the worm through the centre of the cork.

Sold by the Patentee at 56 and 57 Cornhill, and 23 and 24 Fleet-street, London; and may be had at all Cutlers' and Ironmongers'. (254)

BY HER MAJESTY'S ROYAL LETTERS PATENT.

PATENT SPHERICAL SELF-ADJUSTING BEARINGS, which do not heat in work. The advantages possessed by these Bearings are:—

1st. They are Self-adjusting; and, consequently, can be put down by the most ordinary Mechanic.
2nd. They are not liable to heat, even at high speeds.
3rd. They remain constantly parellel to the Spindle; and, therefore, wear equally all across the Bearing.
4th. They require only a very small quantity of oil.

Engravings and Prices forwarded on application to the Patentees.

WALLIS & HASLAM,
Engineers and Iron Founders, North Hants Iron Works, Basingstoke. (197)

AGENTS FOR ALL THE LEADING IMPLEMENT MANUFACTURERS.

WILLIAM DRAY and COMPANY, Agricultural and General Engineers, &c., Adelaide Place, London Bridge, invite attention to their new Central Premises, close to London Bridge, where may be seen their celebrated Champion Reaper, Chaff Engines, Oat Bruisers, Post Mills, Pumps, Weighing Machines, Corn Bins, their Patent Self-Adjusting Scythe, Garden Engines, Handsome Garden Seats, Lawn Mowers (every make), Flower Stands, and Garden Tools of all descriptions.

NOTE.—Descriptive Catalogues of any particular class of Implements forwarded post free upon application. (318)

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IMPROVED MACHINERY FOR AGRICULTURISTS.

RICHARD GARRETT & SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

(ESTABLISHED A.D. 1778),

EARNESTLY solicit the continued support of their numerous Friends, Agriculturists, Shippers, and others; the additions made to their Works during the present year, in the erection of new sets of Workshops, fitted with the best mechanical appliances for producing Machinery of the most improved construction, expeditiously and economically, justifies their soliciting increased support, while their leading reputation as Inventors and Manufacturers of FIRST CLASS Agricultural Machinery, is a sufficient guarantee that every Machine supplied from Leiston Works will prove to the entire satisfaction of the purchaser.

R. G. & S. are now manufacturing the following Machines and Implements, which they guarantee to be thoroughly efficient in every respect:—

PORTABLE AND FIXED STEAM ENGINES. } From 4 to 40 Horse Power, suited for every kind of work
SELF-PROPELLING AND TRACTION ENGINES. } to which Steam Power is applied.
STONE GRINDING MILLS.
MORTAR AND PUG MILLS.
MILLWRIGHTS' WORK of all kinds.
SAWING MACHINERY, from 4 to 20 Horse Power.
BRICK AND TILE MACHINES.

IMPROVED SETS OF FARM MACHINERY, for Large Occupations.
PORTABLE AND FIXED MACHINERY, for Thrashing and Dressing Corn.
THE PRIZE BOLTING AND OPEN-DRUM HORSE-POWER THRASHING MACHINES.
CORN DRESSING MACHINES, for Hand, Horse, Water, and Steam Power.
BARLEY AVELLING MACHINES.
CHAFF CUTTERS, for Hand, Horse, Water, and Steam Power.
PATENT TURNIP CUTTING AND PULPING MACHINES.

THE PRIZE CORN AND SEED DRILLS.
PRIZE CORN AND SEED DRILLS WITH MANURE APPARATUS.
PRIZE SEED AND MANURE DRILLS.
LIQUID, SEED, AND MANURE DROP DRILLS.
CHAMBER'S PATENT BROADCAST MANURE DISTRIBUTOR.
GARRETT'S PATENT HORSE HOE for all Crops.
PATENT REVOLVING HOES for Root Crops.
IMPROVED PLOUGHS AND REAPING MACHINES.
&c. &c. &c.

Of which full detailed particulars will be found in R. G. & SONS' ILLUSTRATED CATALOGUE, sent postage free to any address, in English, French, or German; and any of the above Machines will be shown in operation at R. G. & Sons' Farm, near the Works, on their receiving a few days' notice.

A Copy of R. G. & SONS' new COLONIAL LIST will be forwarded free to any of the Colonies, and Shippers will be supplied with these lists, with their names and addresses printed on, free of charge, by making application for the same.

ADDRESS—R. GARRETT & SONS, LEISTON WORKS, SAXMUNDHAM, SUFFOLK. (161)

RICHARD GARRETT AND SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

Beg respectfully to call attention to their

NEWLY-INVENTED "FIXED" AND "PORTABLE" COMBINED FINISHING, THRASHING, AND DRESSING MACHINES.

THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit for market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel may be stated as follows:

1st. Their compactness; being fully one-third less in size and bulk than the ordinary Machines hitherto in use for the same purpose.

2nd. The great reduction in the number of wearing parts. In these Improved Machines more than one-half the spindles, pulleys, bearings, and driving belts required for the ordinary Machines are dispensed with.

3rd. The novel arrangement by which the Dressing Apparatus is instantly varied, while the Machine is at work, to suit all kinds and conditions of grain.

4th. The very important saving in the cost of keeping the Machines in working order, consequent on the great reduction in the number of wearing parts.

N.B.—Catalogues in English, French, or German can be obtained FREE, on application being made to R. G. & SONS, at LEISTON WORKS, SAXMUNDHAM, SUFFOLK. (314)

SCOTT'S

PATENT GRASS SEED SEPARATOR,

which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

PERENNIAL AND ITALIAN RYE-GRASS, &c.,

AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

These Machines were admittedly the most novel, and, at the same time, the most useful and important to the Farmer of any exhibited at the late SMITHFIELD CLUB SHOW.

They may be seen at work at the Establishment of the Manufacturer,

Mr. T. MIDDLETON, Engineer, Southwark.

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Manufacturers of all descriptions of

VULCANIZED INDIA-RUBBER,

SHEETS, WASHERS,

HOSE-PIPES, TUBINGS, ETC.;

Sole Manufacturers of

WARNE'S PATENT INDIA-RUBBER TUBULAR MATS,

For Doorways, Stairs, Baths, Carriages, Ships, &c., which never clog, require no beating, and, unlike all other Mats, are readily cleansed by water. Indestructible by damp, these Mats are especially suitable for uncovered Passages, and out of door purposes. Seat Mats, Housemaids' Mats, and Brushes for wooden and stone floors.

Sole Manufacturers of

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Possessing advantages over all the ordinary makes, in exceeding toughness, and flexibility, and consequent durability, while neither heat nor cold has effect upon it. Widths, 3/4s., 4/4s., 6/4s., and 7/4s. Substances, ⅛, ¼, and thicker if required. Length, 20 to 25 yards.

Patentees of the Red Mineralised India Rubber—th only Rubber not affected by Oil.

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18th May, 1859. (264

VOKINS & HURD,

SEYMOUR HOUSE, JUBILEE PLACE, CHELSEA.

HOT-HOUSE BUILDERS

AND

Hot-Water Apparatus Manufacturers.

Plans and Estimates forwarded on Application. (149)

CHUBB'S LOCKS, FIREPROOF SAFES, CASH AND DEED BOXES.

Complete lists of sizes and prices may be had on application

CHUBB AND SON,

57 ST. PAUL'S CHURCHYARD, LONDON;

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HIGH-PRESSURE VALVE-COCKS LAMBERT'S PATENT.

Equilibrium Ball Valve. Cottage Closet Valve.

The Equilibrium Ball-Valve is simple and certain in its action, and is cheaper than the common cocks now in use.

The Cottage Valves are suitable for application to any kind of basin; and, as they shut against the pressure, no concussion in the pipes can possibly occur.

These cocks have been extensively and most successfully used in many towns, under continuous high pressure, varying from 100 to 350 feet; their efficiency and durability is, by experience, established.

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13 DOCK-STREET, DUNDEE. (280

GLENFIELD PATENT STARCH,

USED IN THE ROYAL LAUNDRY,

AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.

WHEN YOU ASK FOR

GLENFIELD PATENT STARCH,

SEE THAT YOU GET IT,

as inferior kinds are often substituted.

Sold by all Chandlers, Grocers, &c., &c. (73)

THE SILVERTOWN INDIA-RUBBER WORKS

OPPOSITE H. M. DOCKYARD, WOOLWICH.

INDIA-RUBBER MANUFACTURES

WITH ALL RECENT IMPROVEMENTS.

Warehouses, 3 and 4 Bishopsgate Within, E.C. (145)

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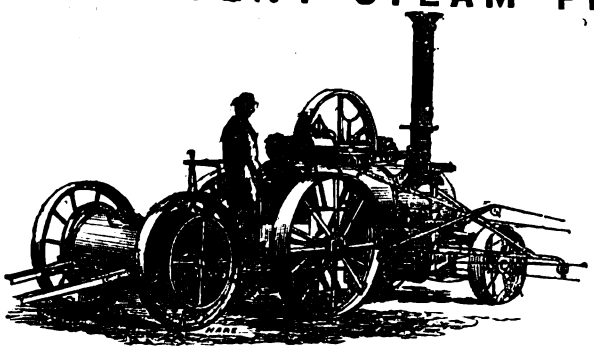
FOWLER'S PATENT STEAM PLOUGH.



The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching Plough, and Scarifier.

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JOHN FOWLER, JUN., 28 CORNHILL, LONDON, E.C.

CLAYTON, SHUTTLEWORTH, AND CO.,

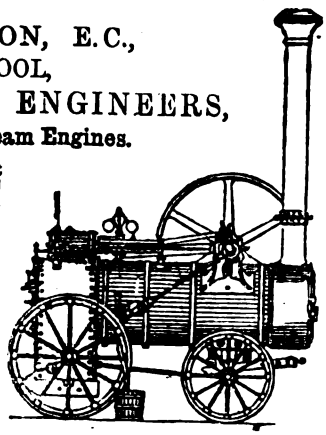
OF LINCOLN,

78 LOMBARD STREET, LONDON, E.C.,

AND 36 DALE STREET, LIVERPOOL,

AGRICULTURAL AND GENERAL ENGINEERS,

And Manufacturers of Portable and Fixed Steam Engines.



Combined Threshing Machines, which dress the corn ready for market at one operation. Grinding Mills, Saw Benches, Pumps for Irrigation and Mining purposes, with all necessary gearing for being driven by steam power. Full particulars and estimates given on application to the above address.

C. S. and Co.'s PORTABLE STEAM ENGINES are adapted for every purpose to which steam-power can be applied. When intended for winding, they are fitted with reversible link motion and winding gear. They are easy of removal, as may be seen by the engraving, and can be set to work immediately on arrival.

C. S. and Co. are now doing an extensive foreign and colonial business, and are prepared to send off engines and machinery of the before-mentioned kinds in a few days from the date of order. They would also call attention to the important *reduction in prices* made for the new year.

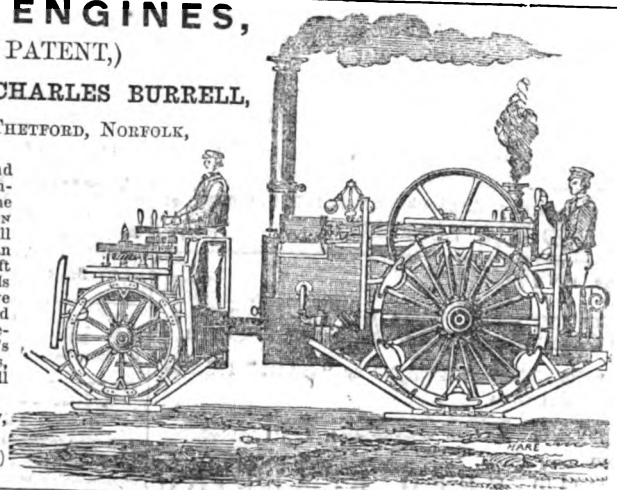
For Exportation.—The above can be obtained through British Merchants, Shippers, and Colonial Agents. (23)

TRACTION ENGINES,

(BOYDELL'S PATENT,)

MANUFACTURED BY CHARLES BURRELL,

ST. NICHOLAS WORKS, THETFORD, NORFOLK,



And ordered for India, Australia, and South America, may now be seen, complete and in course of construction at the above works. BOYDELL'S TRACTION ENGINES AND ENDLESS RAILWAY will draw heavier loads over good roads than any other traction engine, and on soft and bad roads will draw heavy loads where no other traction engine can move itself. All objection to the wear and tear of these Engines is entirely removed by the use of Charles Burrell's improved patent Wrought Iron Wheels, fitted with Rails and Tyre, as well as all the wearing parts, of Steel.

47 *Apply also to Mr. Hemming, Mark Lane, E.C.*

(40.)

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(SUCCESSORS TO GEORGE B. LLOYD & CO.)

GAS STREET AND BERKLEY STREET,

BIRMINGHAM,

Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES.

(139)

MATHEMATICAL DRAWING INSTRUMENTS, RULES, TAPES, CHAINS, LEVELS, THEODOLITES, BOX SEXTANTS, PRISMATIC and POCKET COMPASSES. Price Lists of the above articles sent post free, by JOHN ARCHBUTT, 20 Westminster Bridge Road, Lambeth, near Astley's Theatre. Every article warranted, and the prices will be found considerably lower than ever before charged for articles of similar quality. Routledge's Engineers' Slide Rules, 4s. 6d. each; Hawthorn's ditto, 5s. 6d.: Carpenters' Rules from 1s. (140)

CHADBURN BROTHERS'

PATENT METALLIC STEAM GAUGES.

THESE GAUGES have been in use more than three years, and have given general satisfaction. Those first fixed are now in as good working condition as ever. Testimonials, &c., may be seen at CHADBURN BROS.' Works, Sheffield.

The Gauges may be had of Messrs. Elliott Bros., Strand; Mr. Fenn, Newgate-street; Messrs. Dring and Fage, Tooley-street; Messrs. Nigretti and Zambra, Holborn. (138)

RANSOMES AND SIMS,

IPSWICH,

AGRICULTURAL & GENERAL ENGINEERS

AND

IRONFOUNDERS.

LONDON OFFICE: 31 ESSEX STREET, STRAND, W.C.

(145)

Important to every man who keeps

THORLEY'S FOOD FOR CATTLE,

77, NEWGATE STREET, LONDON

Price 50s. per Cask, containing 448 Feeds

Carriage paid to any Station.

A Pamphlet, Post-free on application. (133)

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding

[EDITED BY R. A. BROOMAN AND E. J. REED.]

(Registered for transmission abroad.)

PRICE, FOURPENCE. By Post 5d.

VOL. 2.—NO. 37. [NEW SERIES.]

LONDON: FRIDAY EVENING, SEPTEMBER 9, 1859.

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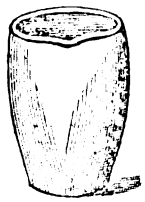

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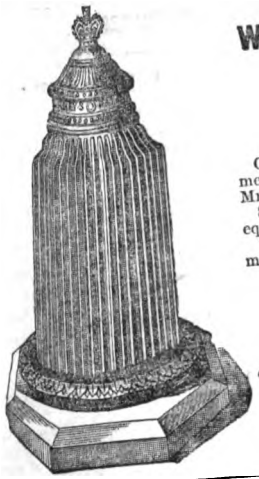

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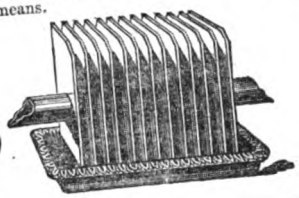

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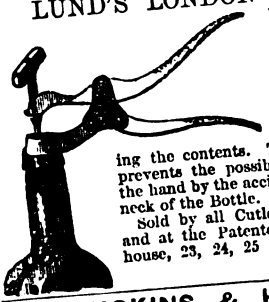

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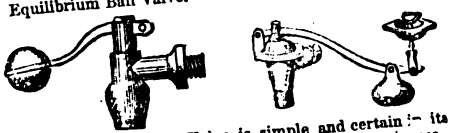

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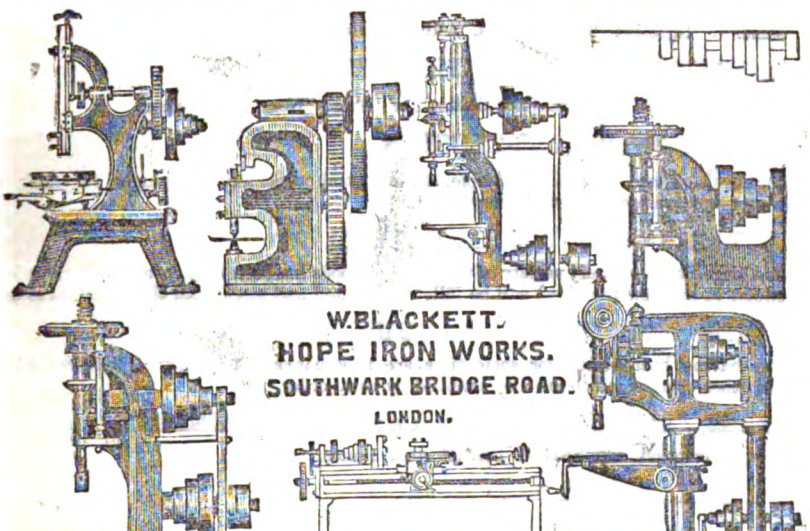

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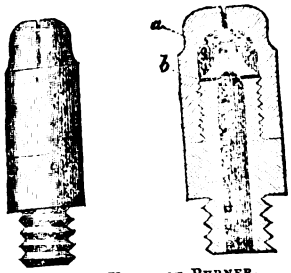

ENLARGED VIEWS OF BURNER.

a Chamber for gas before passing through ordinary slit in caps of Burner.
b Lateral openings for filling the chamber *a*, their direction being at an angle with or across the opening in cap of burner.

THE Patentees have great pleasure in introducing the ECONOMIC GAS BURNER to the notice of the gas consuming public, and feel confident it will be found to possess advantages that cannot be claimed for any other gas burner in present use. This invention may also be called an Anti-pressure Gas Burner, being found to resist a pressure varying from 1¼ in. to 2½ in., and giving a light more than double that of the common tulip burner with the same consumption of gas.

In answer to any inquiry which might be made as to how this greatly superior light can be produced from the same quantity of gas, it might be said—by more completely consuming the carbon in the gas.

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TESTIMONIALS.

Saltaire, June 14th, 1859.

Messrs. Oldfield and Dixon,
Gentlemen—We have now a considerable number of your Patent Gas Burners in use, and believe there is a great saving over the old burners, but to what extent we cannot say.—We are, gentlemen, yours truly
TITUS SALT, SONS, & Co.

Low Mill, Keighley, June 16th, 1859.

Messrs. Oldfield and Dixon,
Gentlemen—We have great pleasure in being able to speak very favourably of your Patent Gas Burners, and think the following statement will sufficiently prove an economy in the consumption of gas. About the 20th December last, we placed your No. 2 burners in the shed, and No. 1 burners in the upper rooms of the mill, where the gas had attained a little extra pressure. Previous to the above date we were making gas from five retorts, but since we have been able to dispense with the use of two. We would add that though this gives evidence of a great saving, an equal recommendation rests in the fact of the light produced being of a superior brilliancy and softness.—Yours very respectfully,
J. & J. CRAVEN & Co.

Primrose Mill, Embsay, near Skipton, June 20th, 1859.

Messrs. Oldfield and Dixon,
Gentlemen—We are glad to report favourably of your Patent Gas Burner, but regret we cannot give you a fair statement of the saving per cent., as we had them put on irregularly some weeks after we had begun to light up. We have usually consumed forty tons of coal for gas; this season we have from six to seven tons on hand, and have made the gas required with one retort—previously we were compelled to use two. We consider the brilliancy of the light and the purity of the atmosphere, through the gas being properly consumed, an attainment quite equal to the economy in fuel.—We are, gentlemen, yours respectfully,
ROBINSON & WILKINSON.

Carleton, near Skipton, July 8th, 1859.

Messrs. Oldfield and Dixon,
Gentlemen—We applied your Patent Gas Burner to all our lights in the beginning of last winter; it gave us great satisfaction, and we calculate the saving of gas about 20 per cent., besides a much superior light to the old burner.—Yours respectfully,
WM. & JNO. SLINGSBY.

Fullage Mill, Burnley, July 12th, 1859.

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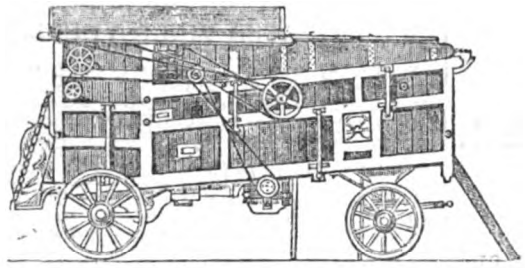

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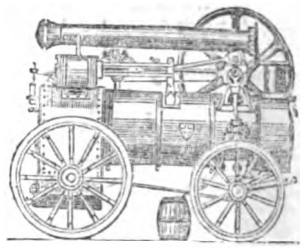

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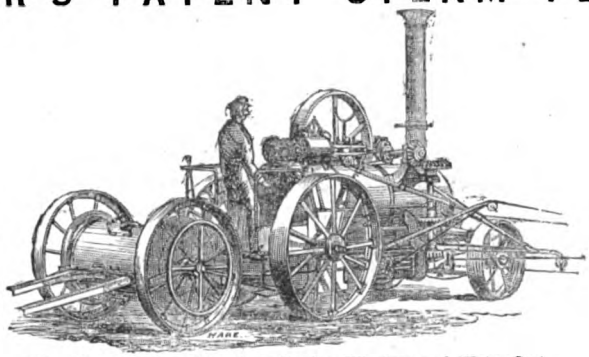

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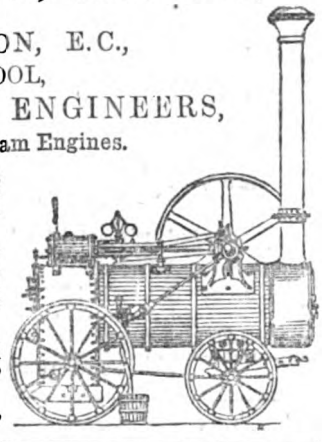

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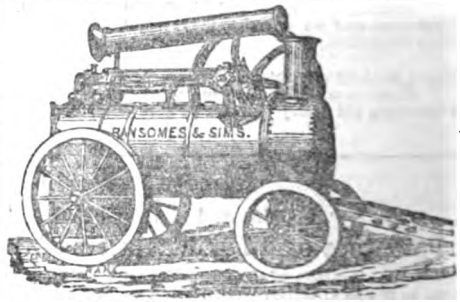

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 38. [NEW SERIES.]

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PRICE, FOURPENCE. BY POST 5d.

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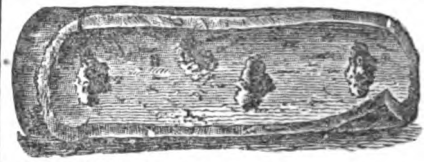

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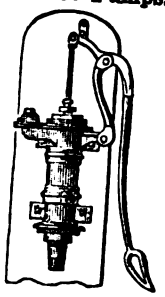

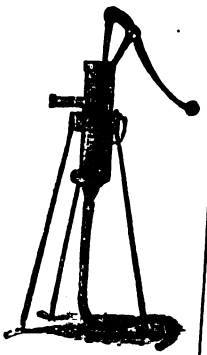

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Dia.	Height.	£ s.
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2½ in. long	3 ,, 3 ,,	1 14
3 ,,	6 ,, 6 ,,	2 8
3½ ,,	3 ,, 6 ,,	3 3
4 ,,	3 ,, 6 ,,	3 3
2½ ,,	3 ,, 6 ,,	3 3
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2½ in. long. do. do.		2 18

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2½ inch	6 0
3 ,,	7 5
3½ ,,	8 0

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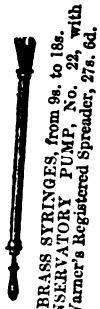

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THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit or market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel ay oe stated as follows:

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Hot-Water Apparatus Manufacturers.

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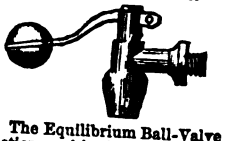
HIGH-PRESSURE VALVE-COCKS.

LAMBERT'S PATENT.

Equilibrium Ball Valve. Cottage Closet Valve.



The Equilibrium Ball-Valve is simple and certain in its action, and is cheaper than the common cocks now in use.

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For Swing Doors, are stamped with Name and Address, thus—

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PATENT GAS BURNER.

ALSO,

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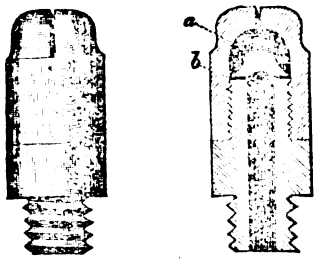

ENLARGED VIEWS OF BURNER.

a Chamber for gas before passing through ordinary slit in caps of Burner.
b Lateral openings for filling the chamber *a*, their direction being at an angle with or across the opening in cap of burner.

THE Patentees have great pleasure in introducing the ECONOMIC GAS BURNER to the notice of the gas consuming public, and feel confident it will be found to possess advantages that cannot be claimed for any other gas burner in present use. This invention may also be called an Anti-pressure Gas Burner, being found to resist a pressure varying from 1¼ in. to 2½ in., and giving a light more than double that of the common tulip burner with the same consumption of gas.

In answer to any inquiry which might be made as to how this greatly superior light can be produced from the same quantity of gas, it might be said—by more completely consuming the carbon in the gas.

It is well known that pure hydrogen gas possesses in itself but a very feeble illuminating property. It is to the presence of carbon, and its proper union with the oxygen of the atmosphere during the process of combustion, that the illuminating property is due. The Patentees flatter themselves that they have succeeded with their Burner in making the gas escape in a more favourable state for the reception of its proper quantity of oxygen, and thus more completely converting the carbon into carbonic acid, by which a better light is obtained, and the black deposition of carbon or soot is avoided. The purity of the light thus produced, it may confidently be asserted, will prove a blessing to all in point of health. It may be said further, in recommending this burner to the public, that it is simple and neat in its construction, easy to clean, not liable to corrode, and being made of brass is likely to last for many years.

Nos. 0, 1, 2, 3, 4, Batwing, and Nos. 1 and 2 Tulip, 4s. 6d. per dozen.
Nos. 3 and 4 Tulip, 5s. 6d. per dozen.
One sent through the post on the receipt of Seven Postage Stamps.

TESTIMONIALS.

Messrs. Oldfield and Dixon, Saltaire, June 14th, 1859.

Gentlemen—We have now a considerable number of your Patent Gas Burners in use, and believe there is a great saving over the old burners, but to what extent we cannot say.—We are, gentlemen, yours truly
TITUS SALT, SONS, & Co.

Messrs. Oldfield and Dixon, Low Mill, Keighley, June 16th, 1859.

Gentlemen—We have great pleasure in being able to speak very favourably of your Patent Gas Burners, and think the following statement will sufficiently prove an economy in the consumption of gas. About the 20th December last, we placed your No. 2 burners in the shed, and No. 1 burners in the upper rooms of the mill, where the gas had attained a little extra pressure. Previous to the above date we were making gas from five retorts, but since we have been able to dispense with the use of two. We would add that though this gives evidence of a great saving, an equal recommendation rests in the fact of the light produced being of a superior brilliancy and softness.—Yours very respectfully,
J. & J. CRAVEN & Co.

Messrs. Oldfield and Dixon, Primrose Mill, Embsay, near Skipton, June 20th, 1859.

Gentlemen—We are glad to report favourably of your Patent Gas Burner, but regret we cannot give you a fair statement of the saving per cent., as we had them put on irregularly some weeks after we had begun to light up. We have usually consumed forty tons of coal for gas; this season we have from six to seven tons on hand, and have made the gas required with one retort—previously we were compelled to use two. We consider the brilliancy of the light and the purity of the atmosphere, through the gas being properly consumed, an attainment quite equal to the economy in fuel.—We are, gentlemen, yours respectfully,
ROBINSON & WILKINSON.

Messrs. Oldfield and Dixon, Carleton, near Skipton, July 8th, 1859.

Gentlemen—We applied your Patent Gas Burner to all our lights in the beginning of last winter; it gave us great satisfaction, and we calculate the saving of gas about 20 per cent., besides a much superior light to the old burner.—Yours respectfully,
WM. & JNO. SLINGSBY.

Messrs. Oldfield and Dixon, Fullage Mill, Burnley, July 12th, 1859.

Gentlemen—You have succeeded in inventing an ingeniously contrived Gas Burner, to the illuminating and economising efficiency of which we have pleasure in adding our testimony.—Yours very truly,
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(337)

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INVITE the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES.

(193)

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PATENT METALLIC STEAM GAUGES.

THESE GAUGES have been in use more than three years, and have given general satisfaction. Those first fixed are now in as good working condition as ever. Testimonials, &c., may be seen at CHADBURN BROS.' Works, Sheffield.

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(165)

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AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

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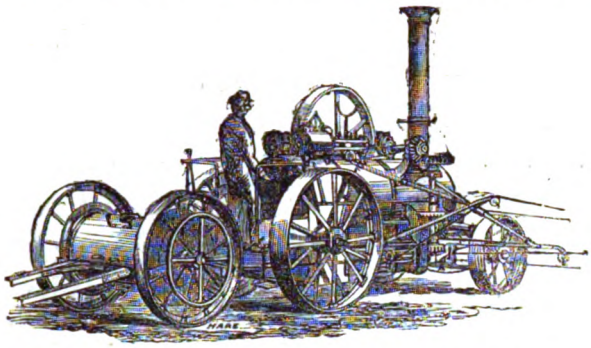

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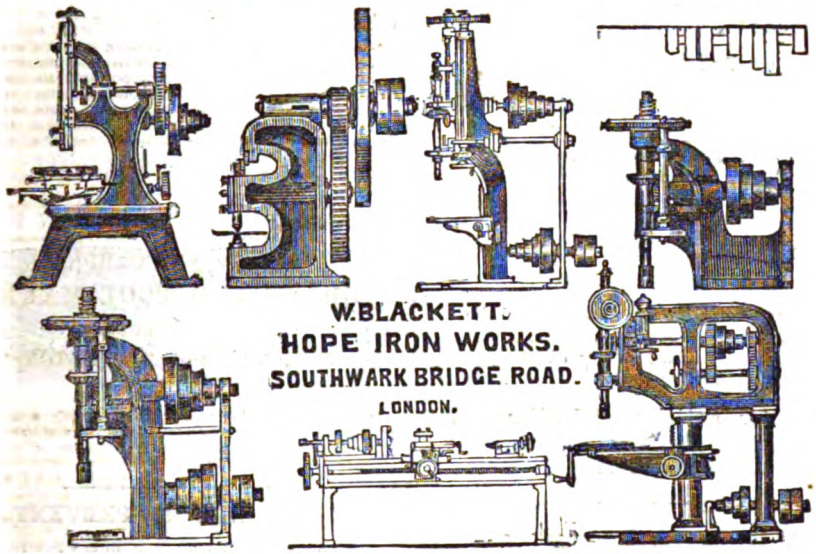

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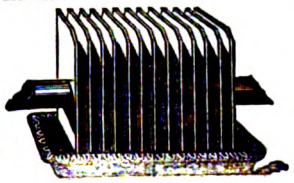

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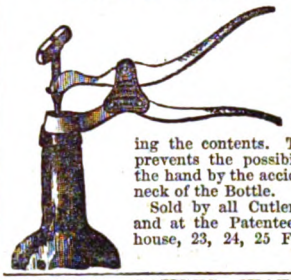

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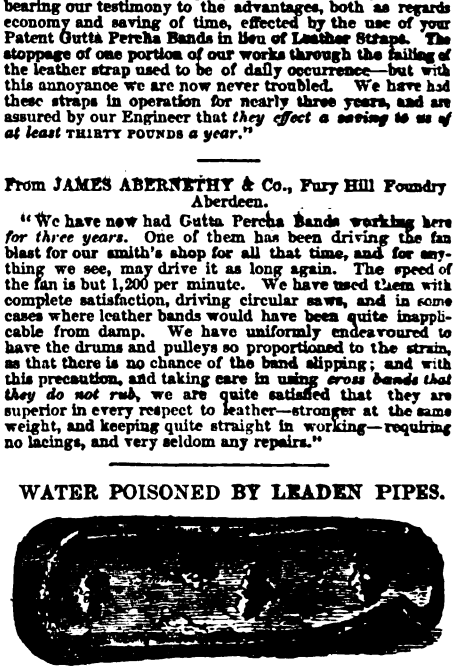

The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight.

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LIST OF MISCELLANEOUS TENDERS IN VITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

MANSION, *Scotland*.—Mansion and offices at Drumpark, seven miles from Dumfries, for Francis Maxwell, Esq. Plans, &c., at the chambers of M'Kie, writer in Dumfries. Tenders to Mr. John Cunningham, Liverpool, Oct. 1.

RAILWAY WORKS, *Ireland*.—The time for receiving tenders for the execution of the works between Newtownards and Bangor and Donaghadee, on the Belfast and County Down Railway has been extended to Oct. 4. Plans, &c., at the office of the Secretary, Mr. T. Ward, Queen's Quay, Belfast.

RAILWAY STATION HOUSE, *Scotland*.—And goods shed, for Killochan Station of the Maybole and Girvan Railway. Plans, &c., Secretary's office, Girvan. Further information of the engineer, Mr. J. Miller, 25 Northumberland-street, Edinburgh. Tenders to Mr. J. Maclinmont, Secretary, Girvan, Sept. 27.

RAILWAY STORES, *South Eastern*.—For the supply of stores from Sept. 30th, 1859, to March 31st, 1860. The articles include iron, axles, tyres, forgings, &c.; general ironmongery, tools, &c.; files, steel, springs, &c.; sheet-brass, brass and copper tubes, finished brass works, &c.; and tin, tin-work, lead, zinc, and other metals. Specifications and forms, Storekeeper, London-bridge terminus. Patterns at Bricklayers' Arms station. Tenders, Sept. 27, to S. Smiles, the Secretary, London-bridge terminus.

TIMBER, *Falmouth Docks*.—For the supply of about 98,000 cubic feet of American red pine, Memel and Dantzic timber. Specifications and conditions, Mr. J. P. Bennetts, Secretary to the Docks Company; or to Mr. J. Abernethy, C.E., 3 Parliament-street, Westminster. Tenders at the office of the company on the 30th inst.

MASTS, *Navy*.—For supplying Her Majesty's dockyards with North American yellow pine masts, yards, and bowsprits, ash oar rafters, and spruce deals, red pine, yellow pine, and rock elm timber. Form and conditions, Somerset-place. Tenders, with attendance, personally, or by agent, two o'clock, Oct. 25, with bond for £2,000.

WATER-PIPES, *Scotland*.—Wanted immediately three-quarters of a mile of cast-iron water-pipes, best quality, of six feet lengths, and one and a half inches diameter; each pipe to be properly tested, to bear a heavy pressure. The pipes to be laid down at Maryport. Particulars, Mr. W. M. Sewell, Hayborough House, by Maryport.

WATER METERS, *Liverpool*.—The makers of meters are invited to send a sample of 1-in. meter, together with a statement of the price at which the meter would be supplied, to the Water-Works office, Holtham-street, Liverpool, Oct. 15.

ROAD, *Ashton-under-Lyne*.—About three miles in length, between Hurst and Lees. Plans, sections, and quantities, at the offices of Mr. T. Hill, Surveyor to the Earl of Stamford, Ashton-under-Lyne, where tenders until Sept. 30.

CEMETERY AND CHAPELS, *Oundle*.—Laying out the ground, forming roads, walks, fencing, draining, and turfing. Plans, &c., Mr. Browning, architect, Stamford. Tenders, Sept. 30. Also two chapels, with lodge, entrance gates, &c. Particulars, Mr. Browning, to whom tenders, Sept. 30.

PARSONAGE, *Shropshire*.—The time for receiving tenders for Ambiecote Parsonage is extended to Sept. 26, when they must be delivered to the Rev. J. W. Grier, Stourbridge.

CHAPEL AND SCHOOLS, *Burnley*.—New Congregational chapel, and foundation of the schools, Drawings, warehouse of Messrs. Lomas and Bowen, on and after Oct. 5. Each tender to be for the whole works. Quantities free, Messrs. Bateson and Hunt, 11 Park-street, Westminster, to whom application for copies forthwith. Tenders addressed to Mr. H. J. Paull, architect, Cardiff, care of Messrs. Lomas and Bowen, Burnley.

SCHOOLS AND TEACHER'S HOUSE, *Redditch*.—For the Wesleyan denomination. Plans and specifications, Rev. E. Shelton, Redditch; to whom tenders, Oct. 4. Architect, Mr. J. Wilson, Belmont, Bath.

MANSION AND OFFICES, *Scotland*.—At Drumpark, seven miles from Dumfries, for F. Maxwell, Esq. Plans, &c., at the chambers of Mr. J. M'Kie, writer, Dumfries. Tenders, Mr. J. Cunningham, architect, Liverpool, Oct. 1.

FOUNDATIONS, ASSIZE COURT, *Manchester*.—For the brickwork and masonry required in the foundations of the Manchester Assize Courts. Drawings, &c., and bills of quantities on application at the office of Mr. A. Waterhouse, architect, Cross-street Chambers, Manchester. Tenders Sept. 29.

PURCHASE OF EMERY STONE, *Greece*.—For the purchase of a quantity not exceeding 25,000 quintals of Naxos Emery Stone. Tenders and personal attendance or by deputy at St. Panteleimon-place, Athens, from 9 to 12, Oct. 1. Previous deposit of 10,000 drachms in the National Bank of Greece. Full particulars by personal application at the office of the Consulate General of Greece, London.

PLANS FOR LAYING OUT GROUND, *Scotland*.—For the best method for laying out for building purposes part of the estate of Granton, near Edinburgh, the property of his Grace the Duke of Buccleuch and Queensbury. Also plans for the different classes of houses proposed to be erected. For the most approved plan a premium of £75, for the second, £50, and for the third, £25. Plan of the ground and all particulars by personal application to Mr. Hawkins, C.E., Granton Harbour, between 11 and 1 o'clock. Where also there are printed copies of the conditions. Plans to Messrs. Gibson, W.S., No. 12 Charlotte-street, Edinburgh, March 1.

MOULDERS' FOREMAN.—Wanted in an iron foundry a working foreman who understands both sand and loam moulding. A good character indispensable. Apply to Messrs. Wailes and Robinson, engineers, 258 Euston-road, London, N.W.

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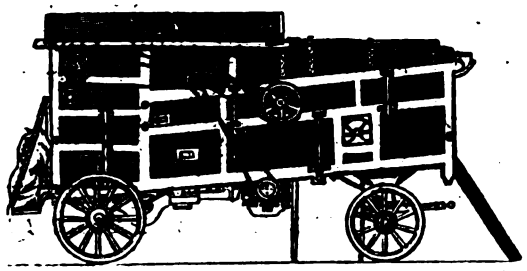

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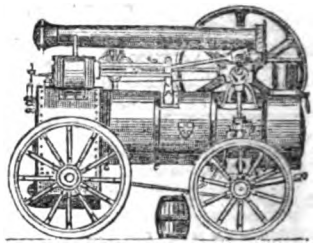

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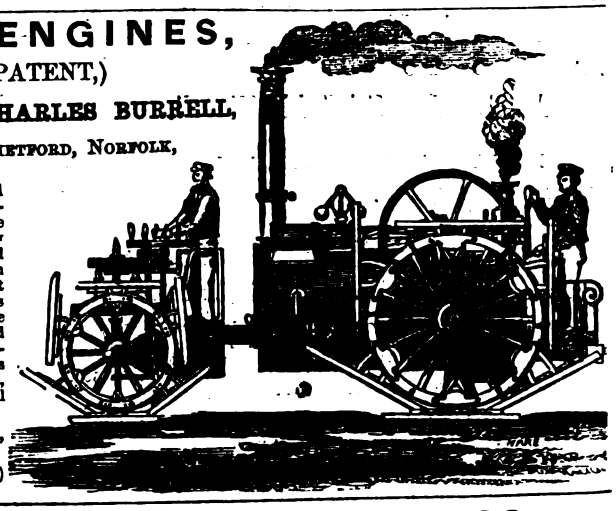

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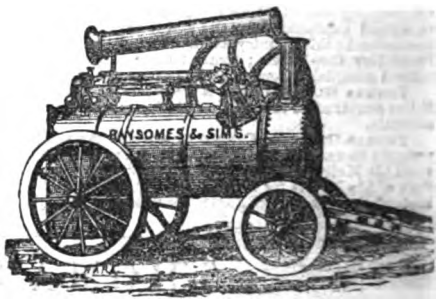

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 40. [NEW SERIES.]

LONDON: FRIDAY EVENING, SEPTEMBER 30, 1859.

PRICE, FOURPENCE. BY POST 5d.

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LIST OF MISCELLANEOUS TENDERS IN VITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

RAILS FOR SALE, *Scotland.*—The directors of the Glasgow and South Western Railway Company are prepared to sell by tender 2,500 tons of malleable iron rails. Delivery will be given at the Glasgow Station, Shields Junction, Ayr, Troon, or Androssan, in quantities to suit purchasers. Information, Manager's office, Bridge-street, Glasgow; where tenders, Oct. 3.

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RESERVOIR, *Merthyr Tydfil.*—For the formation of a large storage reservoir (of about 100 acres area) and other works, in the valley of the river Taff Fechan. Drawings and specifications inspected, and bills of quantities obtained on payment of 20s., at Mr. J. W. Russell, Clerk to the Local Board of Health, Merthyr Tydfil; and at the office of Mr. Hawksley, Civil Engineer, 30 Great George-street, Westminster, Oct. 3. Tenders at Mr. Russell's office, Oct. 19.

PIER, *Queenborough.*—The directors of the Sittingbourne and Sheerness Railway Company advertise for tenders for construction of pier at Queenborough, in the Isle of Sheppy. Drawings, specifications, and forms, at the office of Mr. J. C. Birkenshaw, 22 Abingdon-street, Westminster. Tenders, Mr. S. J. Breeze, Secretary, 51 King William-street, London, E.C., Oct. 10.

RAILWAY WORK, *Lancashire and Yorkshire Railway.*—For the extension of warehouse and other works at the Halifax station. Plans, specifications, and quantities at engineer's office, Hunt's Bank, Manchester, where forms of tender; and to which place tenders must be sent by 10 a.m., Oct. 4, to Mr. W. S. Lawn, Secretary.

LOCK AND LOCK FURNITURE, *Navy.*—For supplying Her Majesty's Dockyards under a contract for twelve months certain, and afterwards until after the expiration of three months' notice. Patterns and particulars, Somerset Place. Tenders, two o'clock, Oct. 11, with two sureties for £1,000.

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CHURCH, *Draycot, Somersetshire.*—Parish of Chiddar. Drawings, Rectory, Rodneystoke, till Oct. 3. Tenders there Oct. 4.

RESTORATION, *Fennystanton.*—Interior of the parish church. Plans, &c., at the office of Mr. R. Hutchinson, architect, Market-place, Huntingdon. Tenders, Oct. 4.

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These Small Boats go twice the speed of any others with half the fuel; a Steel Rocket of 150 lbs., steam pressure, 1,000 lbs. (1-20th of gunpowder) would drive a Cylindrical Balloon—with pointed ends, capable of carrying one passenger—ten miles per hour. (350)

BIRMINGHAM WAGGON COMPANY (LIMITED) has RAILWAY WAGGONS for HIRE. Apply to the Secretary, 3 Newhall-street, Birmingham. (276)

WATER GLASS, or SOLUBLE SILICATES of SODA or POTASH, in large or smal quantities, and either Solid or in Solution, at

ROBERT RUMNEY'S, Ardwick Chemical Works, Manchester. (335)

SMALL GAS APPARATUS, WITH FREEDOM FROM NUISANCE.

THE PATENT NATIONAL COAL-GAS APPARATUS,

FOR

Private Residences, Farm Buildings, Churches, Chapels, Railway Stations,

And all isolated places not yet lighted with Gas.

The various parts are of the best materials and workmanship, are not liable to get out of order, and can be worked with a small degree of attention by a farm-servant or labourer without materially interfering with his other duties.

Prospectuses with Testimonials, &c., may be had on application to the Proprietors and Manufacturers,

J. T. B. PORTER and CO., Lincoln. (346)

BY HER MAJESTY'S ROYAL LETTERS PATENT.

To Engineers, Railway, Water, and Gas Companies, Iron Ship and Bridge Builders, Marine, Locomotive and Stationary Boiler Manufacturers &c., Brewers, Distillers, Sugar Refiners, &c.

WARNE'S

NEWLY PATENTED

FERRUGINOUS CEMENT PACKING,

IN SHEETS AND WASHERS,

Applicable to Steam, Water, Air, and Gas Joints of all descriptions, in place of Iron Cement, Sheet Lead, Red and White Lead, Gasket, Millboard, &c.

1. To Cylinder, Air and Vacuum Pump Covers and Doors, Condensers, hot and cold Liquor Pumps, Valve Covers, Steam feed and water flange and socket pipe joints, Man and Mud-Hole joints, to CAST IRON TANKS, and to repairs of Marine, Locomotive, and Stationary Boilers, &c.

2. To RAILWAY purposes, to the bedding of Rails, Chairs, and fish joints, to the bedding and adjusting of Girders and Turn Tables—to the construction of IRON BRIDGES and of IRON SHIPS, and to bedding Marine Boilers on Bearers, &c., &c.

3. To Gas Mains and Pipes, Retort joints, to the construction of Gasometers and Gasholders, &c., &c.

4. To all joints of Steam, hot and cold liquor Pipes and Pumps for Brewers, Distillers, Sugar Refiners, Chemical Manufacturers, Tanners, Dyers, and in fact all uses where the common Iron Cement, Lead, or other joint has been hitherto applied.

The important advantages of the PATENT FERRUGINOUS CEMENT PACKING consists in the *Indestructibility* of the material, either by Fire, Steam, Water, or Gas—in its *instant* and *ready* application—and in its great economy of time and labour in making joints, in place of the ordinary Iron Cement. For all permanent joints (elastic before its application) it can be made to set as hard as Iron, and it will expand and contract in the same ratio as the Metal; while, for all other joints, it can be made sufficiently elastic to answer all the purposes of India-rubber or other Packing.

Directions for Use.—Immediately before use, the Patent Ferruginous Packing, when intended for permanent joints, should be pickled for at least Six Hours in a solution of Sal Ammoniac—¼ lb. to a pint of Water; when not intended for permanent joints, the pickling is not necessary.

Sole Manufacturers—

WILLIAM WARNE & CO.,
9 Gresham-street-west, E.C.—Mills, Tottenham, N. (349)

MATHEMATICAL DRAWING INSTRUMENTS, RULES, TAPES, CHAINS, LEVELS, THEODOLITES, BOX SEXTANTS, PRISMATIC and POCKET COMPASSES. Price Lists of the above articles sent post free, by JOHN ARCHBUTT, 20 Westminster Bridge Road, Lambeth, near Astley's Theatre. Every article warranted, and the prices will be found considerably lower than ever before charged for articles of similar quality. Routledge's Engineers' Slide Rules, 4s. 6d. each; Hawthorn's ditto, 5s. 6d.; Carpenters' Rules from 1s. (148)

FOR CORRECT FAMILY ARMS, CREST, or PEDIGREE, send name and county and 7s. 6d. to J. LOCK'S, City Heraldic Office, No. 2, Old Jewry, E.C., London, and in a few days you will receive a neat drawing of your Arms, &c., in Heraldic Colours, to be engraved on Seal, Ring, or Family Plate. On y parle Français, Italien, Allemand, et Hollandais.

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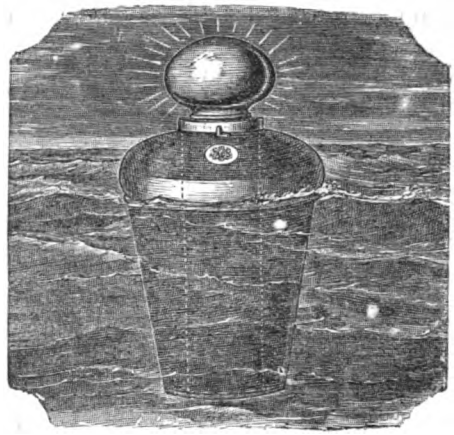
GRESHAM'S RECORD PATENT BUOY.



The RECORD BUOY is intended to be kept in some place available for instant use, and to be thrown overboard from a sinking ship, or a Vessel on Fire, so as to intimate disaster, having a paper inserted therein, already filled up with the Ship's Name, Port of Registry, Official Number, &c., and a few last words hastily written, intimating the nature of the calamity, with any further information that can be given at such a time. It has capacity and buoyancy to contain besides these, the Log Book, and several pounds' weight of Papers or Valuables. It is lined with Cork between the Cylinder and outside case, so that, although waterlogged, it will not sink, but keep afloat for a long time, probably for years.

In order to DISTINGUISH IT FROM ANY OTHER FLOATING SUBSTANCE, so that the Captain of a passing Ship may recognise it as an intimation of disaster, and consider it a sacred and imperative duty to pick it up and convey the information it contains according to the directions found within, it HAS RAISED CONSPICUOUSLY UPON ITS SURFACE A SILVERED GLOBE, which, owing to the reflection of the light, will make it visible at a great distance, and when dancing on the wave it shines, in fact, like a star in the firmament, and being distinguishable from anything else, its character cannot be mistaken.

It is furnished with ample directions to the finder how to act, and has Envelopes already directed to the proper authorities, who, on receipt thereof (and they should be transmitted by the first available means), will, after verifying them to prevent imposition, immediately convey the information to the owners of the lost Ship, to Lloyd's, and all parties concerned; and if a foreign ship, to the consul of the nation to which she belongs.

In order to establish uniformity, and to prevent the uncertainty and confusion which a multiplicity of Buoys of various forms might occasion, when their utility becomes apparent, and to make ESPECIAL RECOGNITION OF THESE UNDOUBTED, MR. JOHN GRESHAM, J.P. and Alderman of Hull, has Patented his Invention, and has arranged with the old-established Firm of

GEORGE AND JOSEPH OLIVER,

286 WAPPING, LONDON, E.,

TO MANUFACTURE AND SUPPLY THEM, AND TO WHOM ALL COMMUNICATIONS SHOULD BE ADDRESSED. (202)

IMPROVED MACHINERY FOR AGRICULTURISTS.

RICHARD GARRETT & SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

(ESTABLISHED A.D. 1778),

EARNESTLY solicit the continued support of their numerous Friends, Agriculturists, Shippers, and others; the additions made to their Works during the present year, in the erection of new sets of Workshops, fitted with the best mechanical appliances for producing Machinery of the most improved construction, expeditiously and economically, justifies their soliciting increased support, while their leading reputation as Inventors and Manufacturers of FIRST CLASS Agricultural Machinery, is a sufficient guarantee that every Machine supplied from Leiston Works will prove to the entire satisfaction of the purchaser.

R. G. & S. are now manufacturing the following Machines and Implements, which they guarantee to be thoroughly efficient in every respect:—

PORTABLE AND FIXED STEAM ENGINES. } From 4 to 40 Horse Power, suited for every kind of work
SELF-PROPELLING AND TRACTION ENGINES. } to which Steam Power is applied.
STONE GRINDING MILLS.
MORTAR AND PUG MILLS.
MILLWRIGHTS' WORK of all kinds.
SAWING MACHINERY, from 4 to 20 Horse Power.
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IMPROVED SETS OF FARM MACHINERY, for Large Occupations.
PORTABLE AND FIXED MACHINERY, for Thrashing and Dressing Corn.
THE PRIZE BOLTING AND OPEN-DRUM HORSE-POWER THRASHING MACHINES.
CORN DRESSING MACHINES, for Hand, Horse, Water, and Steam Power.
BARLEY AVELLING MACHINES.
CHAFF CUTTERS, for Hand, Horse, Water, and Steam Power.
PATENT TURNIP CUTTING AND PULPING MACHINES.

THE PRIZE CORN AND SEED DRILLS.
PRIZE CORN AND SEED DRILLS WITH MANURE APPARATUS.
PRIZE SEED AND MANURE DRILLS.
LIQUID, SEED, AND MANURE DROP DRILLS.
CHAMBER'S PATENT BROADCAST MANURE DISTRIBUTOR.
GARRETT'S PATENT HORSE HOE for all Crops.
PATENT REVOLVING HOES for Root Crops.
IMPROVED PLOUGHS AND REAPING MACHINES.
&c. &c. &c.

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ADDRESS—R. GARRETT & SONS, LEISTON WORKS, SAXMUNDHAM, SUFFOLK. (161)

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TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine

SMITH'S PATENT DOOR SPRINGS,

For Swing Doors, are stamped with Name and Address, thus—

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and that Springs thus marked are warranted.

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are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. (195)

Important to every man who keeps

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Price 50s. per Cask, containing 448 Feeds

Carriage paid to any Station.

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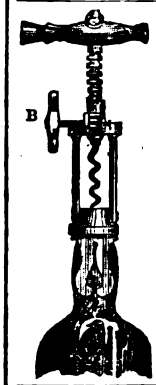

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LONDON RACK CORK SCREWS

on the neck of a bottle, and it is ready for use. Some of these Cork Screws are fitted with Patent Spring Ends to embrace the neck of the bottle, and so direct the worm through the centre of the cork.

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JAMES LYNE HANCOCK,

Vulcanized India-Rubber Works, Goswell-mews, and 8 Goswell-road, London, E.C. (258

RANSOME'S PATENT STONE FILTERS—of every description for Domestic purposes, for Manufactories, Public Companies, Shipping, &c.

For Particulars, Specimens, Illustrations, and Agencies, apply to Mr. Frederick Ransome, Whitehall Wharf, Cannon-row, Westminster; or Patent Stone Works, Ipswich. A Liberal Discount allowed to the Trade or to Shippers. (178)

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SEYMOUR HOUSE, JUBILEE PLACE, CHELSEA.

HOT-HOUSE BUILDERS

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Hot-Water Apparatus Manufacturers.

Plans and Estimates forwarded on Application. (149)

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Complete lists of sizes and prices may be had on application.

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SILVERTOWN INDIA-RUBBER WORKS

OPPOSITE

H. M. DOCKYARD, WOOLWICH.

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Beg respectfully to call attention to their

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THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit or market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel are as follows:

1st. Their compactness; being fully one-third less in size and bulk than the ordinary Machines hitherto in use for the same purpose.

2nd. The great reduction in the number of wearing parts. In these Improved Machines more than one-half the spindles, pulleys, bearings, and driving belts required for the ordinary Machines are dispensed with.

3rd. The novel arrangement by which the Dressing Apparatus is instantly varied, while the Machine is at work, to suit all kinds and conditions of grain.

4th. The very important saving in the cost of keeping the Machines in working order, consequent on the great reduction in the number of wearing parts.

N.B.—Catalogues in English, French, or German can be obtained FREE, on application being made to R. G. & SONS, at

LEISTON WORKS, SAXMUNDHAM, SUFFOLK. 314

D. HULETT & CO.,

55 and 56 HIGH HOLBORN, LONDON,

Patentees and Manufacturers of the only good Mercurial Gas Regulator,

INVITE the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

Manufacturers of

GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

Double Cone, Albert, Shadowless, and every description of Burner, Union Jets, Batswings, &c.;

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Sole Manufacturers of CHURCH & MANN'S PHOTOMETER.

Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s. (294)

MEDALS AWARDED TO

THOMAS GLOVER'S PATENT DRY GAS-METERS.

VIZ.:

GREAT EXHIBITION, LONDON, 1851. | NEW YORK EXHIBITION, 1853.

AND PARIS UNIVERSAL EXHIBITION, 1855.

LONDON, March 25, 1859.

THOMAS GLOVER takes this opportunity of thanking Gas Companies and his other Customers for the very liberal support and patronage he has received during the past year, which has far exceeded his most sanguine anticipations, having sold a greater number of his PATENT DRY GAS-METERS since the dissolution of his partnership with Mr. Croll than he was ever previously enabled to do in any one year.

THOMAS GLOVER confines his sole attention to the business of Gas-Meter Making. The propriety of his doing so is satisfactorily proved by his success; and, without the practice of any quackery, or any attempt to delude the public by an absurd exhibition of "Old and New Valves," his Meters are in general use by the Metropolitan Gas and other Companies in this Country and abroad. For example, one Metropolitan Company have now in use above 12,500 of his Patent Dry Gas-Meters; some of these Meters have been fixed for Fourteen Years, and are still in working order, without complaint from either the Company or the Consumer.

THOMAS GLOVER thinks it necessary to put Gas Companies on their guard against parties selling Patent Dry Gas-Meters constructed in imitation of his, but unskilfully made on erroneous principles, and with improper and unsuitable materials.

THOMAS GLOVER'S Workshops are now the most extensive in this or any other country, and he is thereby enabled promptly to execute orders to any extent required. Purchasers may at any time inspect his Works and the Materials of which his Meters are constructed. He is ready to enter into Contracts with Gas Companies and others to uphold their Stock of his Meters for Twenty Years at an annual charge varying from 2½ to 5 per cent., and to leave always in the hands of Gas Companies Three Years' charge for upholding, as a guarantee for the fulfilment of the Contract.

THOMAS GLOVER,

PATENT DRY GAS-METER MANUFACTURER,

SUFFOLK STREET, CLERKENWELL GREEN, AND

ALLEN STREET, GOSWELL STREET, E.C. (293)

PATENT LEVER BREAKS for RAILWAY WAGGONS, doing away with the objectionable Break Rack. Can be applied to existing stock at a trifling expense. Royalty moderate.

Models can be seen at 31 Great George-street, Westminster, and the Breaks in action at the Works of the Railway Carriage Company at the Peterborough Station, on the Eastern Counties Railway; the Rugby Station, London and North-Western Railway; the Cardiff Docks Station, Taff Vale Railway; and at the Works, Oldbury, near Birmingham, where all communications are requested to be sent. (275)

GLENFIELD PATENT STARCH,

USED IN THE ROYAL LAUNDRY,

AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.

WHEN YOU ASK FOR

GLENFIELD PATENT STARCH,

SEE THAT YOU GET IT,

as inferior kinds are often substituted.

Sold by all Chandlers, Grocers, &c., &c. (75)

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CONDY'S PATENT PURE CONCENTRATED MALT VINEGAR.

Families, by using this delicious VINEGAR, insure purity and effect a saving of 50 per cent. See "Report of Dr. Letheby, City Officer of Health, Dr. Hassall, of the 'Lancet' Commission, and others." Sold by the Trade, in Bottles, labelled and capsuled. Wholesale—63 King William-street, London-bridge, E.C. Six Quart Samples sent free to any Railway for 3s. 6d. (216)

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Hot-Water Apparatus for Conservatories, &c., on the most economical and improved principles.

Also Manufactory for Captain John Grant's much improved Cooking Apparatus. (44)

GLADSTONE & Co., CONTRACTOR and ENGINEERS.

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Are prepared to ESTIMATE FOR and CONSTRUCT BRIDGES, PIERS, JETTIES, &c., in Iron, Wood, or Stone. Also to supply Cranes, Girders, Turntables, and Railway Work and Plant generally. (199)

YORKSHIRE TYRE & AXLE WORKS, ROTHERHAM.

LOCOMOTIVE TYRE-BARS of every description for Engines, Carriages, and Railway Waggon Wheels.

STEEL-IRON for Springs. MERCHANT and other Irons manufactured. WM. F. HOYLE, Proprietor. (278

TO SHIPBUILDERS.

IRON SHIPS may be rendered FIRE-PROOF if internally fitted with Fibrous Slab in lieu of Deal.

Extract from a letter of the Captain of the Royal Bride Steamer, trading between Bristol and Melbourne:—"25th May, 1859.—From my experience of the last nine months in all climates, I have no hesitation in saying there is no kind of lining I know of equal to your Fibrous Slab for Iron Ships.—Yours, &c. (Signed), ALEX. NEWLAND."

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CONDY'S PATENT FLUID, or NATURAL DISINFECTANT,

Not only Deodorizes but Disinfects perfectly, and DESTROYS FOR EVER the cause of infection.

Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.

This fluid has been examined and reported upon by the Board of Health, all the most eminent Men and Chemists of the day, in all cases in the most satisfactory manner possible.

The Public are recommended to use this Fluid, properly diluted with water, frequently and habitually in larders, sculleries, dairies, musty cakes, sick rooms, close places, &c., as it has numerous advantages, and can be used with certain immediate success and perfect safety.

Sold in Quart Bottles, 4s.; Pints, 2s.; Half-pints, 1s. and in bulk, 10s. per Gallon.

Free to Railway on receipt of Order or Stamps. (238)

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THE IMPERIAL IRON TUBE COMPANY,

(SUCCESSORS TO GEORGE B. LLOYD & CO.)

GAS STREET AND BERKLEY STREET,

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Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES.

(193)

SCOTT'S

PATENT GRASS SEED SEPARATOR,

which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

PERENNIAL AND ITALIAN RYE-GRASS, &c.,

AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

These Machines were admittedly the most novel, and, at the same time, the most useful and important to the Farmer of any exhibited at the late SMITHFIELD CLUB SHOW.

They may be seen at work at the Establishment of the Manufacturer,

Mr. T. MIDDLETON, Engineer, Southwark.

Communications to be sent to the Patentee, J. SCOTT, 111 Drummond Street, Euston Square London, N.W. 4

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OF LINCOLN,

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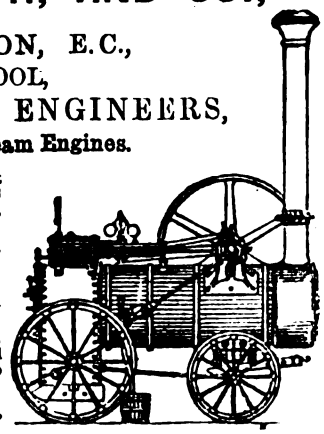
AGRICULTURAL AND GENERAL ENGINEERS,

And Manufacturers of Portable and Fixed Steam Engines.



Combined Threshing Machines, which dress the corn ready for market at one operation. Grinding Mills, Saw Benches, Pumps for Irrigation and Mining purposes, with all necessary gearing for being driven by steam power. Full particulars and estimates given on application to the above address.

C. S. and Co.'s PORTABLE STEAM ENGINES are adapted for every purpose to which steam-power can be applied. When intended for winding, they are fitted with reversible link motion and winding gear. They are easy of removal, as may be seen by the engraving, and can be set to work immediately on arrival.

C. S. and Co. are now doing an extensive foreign and colonial business, and are prepared to send off engines and machinery of the before-mentioned kinds in a few days from the date of order. They would also call attention to the important *reduction in prices* made for the new year.

For Exportation.—The above can be obtained through British Merchants, Shippers, and Colonial Agents. (23)

FOWLER'S PATENT STEAM PLOUGH.

The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching Plough, and Scarifier.

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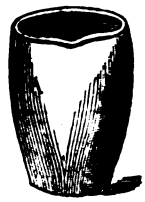
TO BRASS-FOUNDERS, ENGINEERS, &c.



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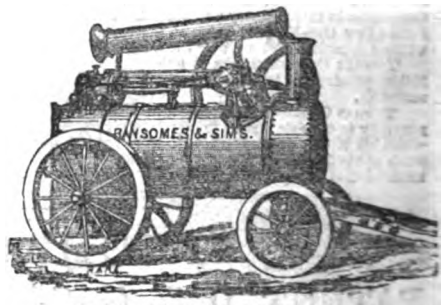

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AGRICULTURAL & GENERAL ENGINEERS

AND

IRONFOUNDERS.

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(185)

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 41. [NEW SERIES.]

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NOTICE TO MACHINE MAKERS, BRICK AND TILE MAKERS.

INFRINGEMENTS ON PATENTS.

I HEREBY GIVE NOTICE, that the Prize Brick-Making Machine lately Exhibited at Warwick by Mr. John Whitehead, of Preston, Lancashire; and since Advertised by him, is a Direct Infringement upon the Patents granted to me, Henry Clayton (13th December, 1852, No. 1045, and 8th October, 1853, No. 2312), and that proceedings are being taken against him. In the meantime, Purchasers or Users of the Machine are cautioned that they will expose themselves to Proceedings for an Infringement of the said Patents.—Dated 29th September, 1859.

HENRY CLAYTON,

Patentee and Engineer, Atlas Works, Upper Park-place, Dorset-square, London.

Solicitors, Messrs. WILSON & BRISTOWS, London. (357)

A COURSE OF SIX LECTURES ON SOCIAL SCIENCE as a branch of School Instruction, especially addressed to Teachers, will be delivered in the Lecture Theatre, South Kensington, by William Ellis, on Tuesday evenings, the 11th, 18th, 25th October; 1st, 8th, and 15th November, 1859; at eight o'clock.

Tickets will be issued at 5s. each for the course, or 1s. each Lecture, at South Kensington.

By order of the Committee of Council on Education. (351)

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THE ANCHOR COMMITTEE AFFIRM "TROTMAN'S PATENT ANCHOR" to be superior to all others, possessing Thirty-Five Per Cent. more Holding Power than either Porter's or Roger's, and equivalent in all respects to ordinary Anchors of 28 per cent. greater weight.

"This appeared to the Committee of vast importance to the Shipping Interests, &c."

(Vide their Official Report, 1853, "On the relative merits of different descriptions of Anchors," sanctioned and approved by the Admiralty.)

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Captain George Rodney Munday, R.N., Her Majesty's Ship "Nile."

Jonathan Aylen, Esq., R.N., Master Attendant, Her Majesty's Dockyard, Sheerness.

James Tonkin, Esq., Master, R.N., Her Majesty's Ship "Waterloo," 120 guns.

William Schaw Lindsay, Esq., M.P., &c., &c.

Duncan Dunbar, Esq., Chairman of General Shipowners' Society; Do. Mercantile Marine Board, London. Member of the Committee of "Lloyd's Register" of Shipping, &c.

Anthony Ridley, Esq., Vice-Chairman of Mercantile Marine Board; Member of the Committee of "Lloyd's Register" of Shipping, &c.

William Drew, Esq., Member of the Mercantile Marine Board; Member of the Committee of "Lloyd's Register" of Shipping, &c.

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JOHN TROTMAN, PATENTEE, 42 CORNHILL, LONDON. (249)

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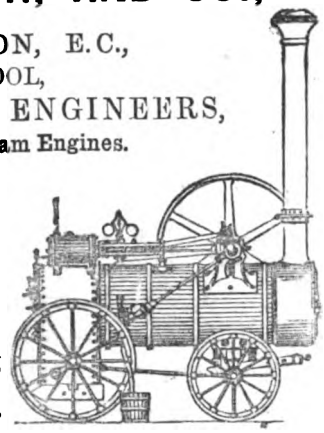

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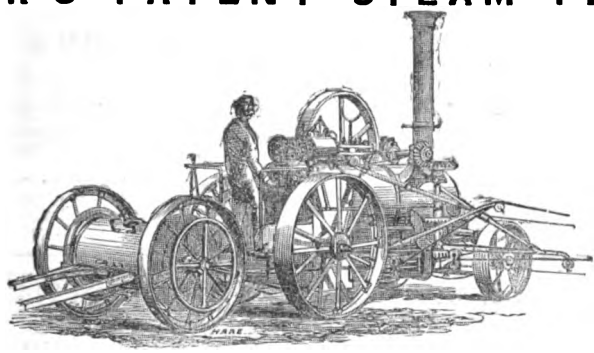

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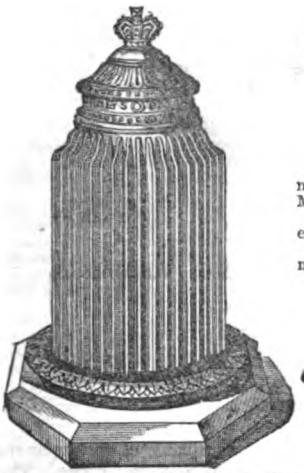

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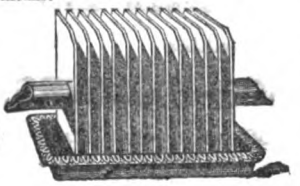

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THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit or market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel ay oe stated as follows:

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2nd. The great reduction in the number of wearing parts. In these Improved Machines more than one-half the spindles, pulleys, bearings, and driving belts required for the ordinary Machines are dispensed with.

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AND PARIS UNIVERSAL EXHIBITION, 1855.

LONDON, March 25, 1859.

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Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.

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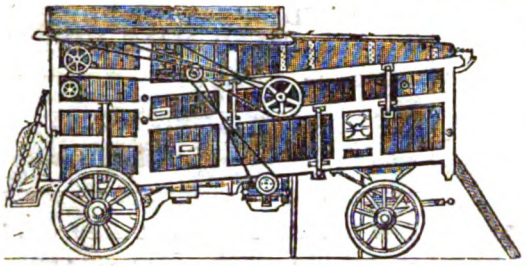

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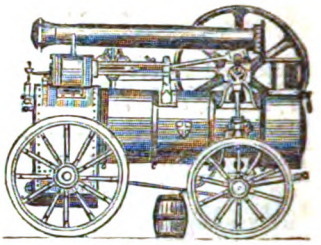

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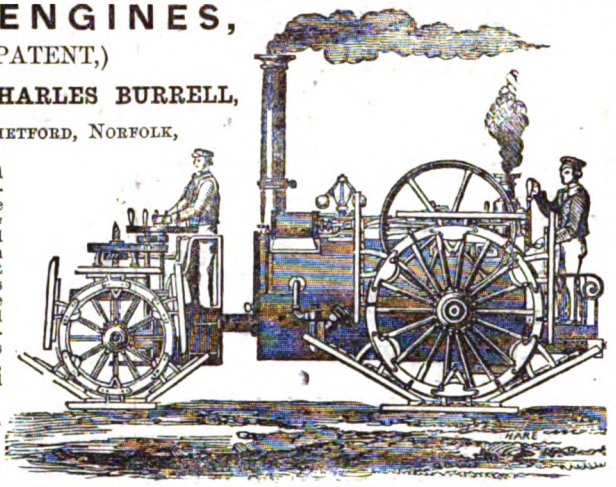

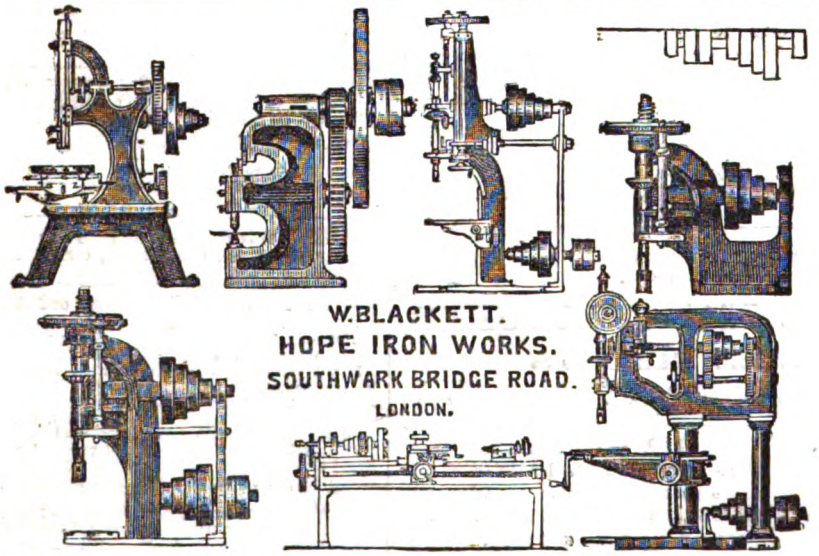

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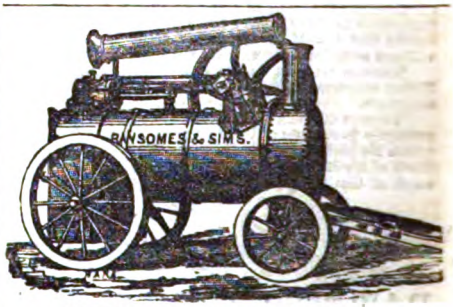

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 42. [NEW SERIES.]

LONDON: FRIDAY EVENING, OCTOBER 14, 1859.

PRICE, FOURPENCE. BY POST 5d.

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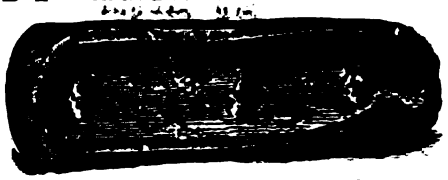

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Applicable to Steam, Water, Air, and Gas Joints of all descriptions, in place of Iron Cement, Sheet Lead, Red and White Lead, Gasket, Millboard, &c.

1. To Cylinder, Air and Vacuum Pump Covers and Doors, Condensers, hot and cold Liquor Pumps, Valve Covers, Steam feed and water flange and socket pipe joints, Man and Mud-Hole joints, to CAST IRON TANKS, and to repairs of Marine, Locomotive, and Stationary Boilers, &c.

2. To RAILWAY purposes, to the bedding of Rails, Chairs, and fish joints, to the bedding and adjusting of Girders and Turn Tables—to the construction of IRON BRIDGES and of IRON SHIPS, and to bedding Marine Boilers on Bearers, &c., &c.

3. To Gas Mains and Pipes, Retort joints, to the construction of Gasometers and Gasholders, &c., &c.

4. To all joints of Steam, hot and cold liquor Pipes and Pumps for Brewers, Distillers, Sugar Refiners, Chemical Manufacturers, Tanners, Dyers, and in fact all uses where the common Iron Cement, Lead, or other joint has been hitherto applied.

The important advantages of the PATENT FERRUGINOUS CEMENT PACKING consists in the *Indestructibility* of the material, either by Fire, Steam, Water, or Gas—in its *instant* and *ready* application—and in its great economy of time and labour in making joints, in place of the ordinary Iron Cement. For all permanent joints (elastic before its application) it can be made to set as hard as Iron, and it will expand and contract in the same ratio as the Metal; while, for all other joints, it can be made sufficiently elastic to answer all the purposes of India-rubber or other Packing.

Directions for Use.—Immediately before use, the Patent Ferruginous Packing, when intended for permanent joints, should be pickled for at least Six Hours in a solution of Sal Ammoniac—½ lb. to a pint of Water; when not intended for permanent joints, the pickling is not necessary.

Sole Manufacturers—
WILLIAM WARNE & CO.,
9 Gresham-street-west, E.C.—Mills, Tottenham, N. (340)

CAUTION.

TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine

SMITH'S PATENT DOOR SPRINGS,

For Swing Doors, are stamped with Name and Address, thus—

SMITH, PATENTEE, 69 PRINCES STREET, LEICESTER SQUARE, LONDON,

and that Springs thus marked are warranted.

SMITH'S PATENT WEATHER-TIGHT CASEMENT FASTENING AND SILL-BARS

are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. (195

BIRMINGHAM WAGGON COMPANY (LIMITED) has RAILWAY WAGGONS for HIRE. Apply to the Secretary, 3 Newhall-street, Birmingham. (276)

TO ENGINEERS, MARINE, LOCOMOTIVE, AND OTHER BOILER MAKERS; IRON-SHIP AND BRIDGE BUILDERS; GAS AND RAILWAY COMPANIES, &c.

WARNE'S NEW PATENT FERRUGINOUS CEMENT PACKING, applicable to Steam, Air, Water, and Gas Joints of all descriptions, Water Tanks and Repairs of Boilers; for Railway purposes, to Chairs and Fish-tail Joints, Turn Tables and Bridge Girders, and to the Construction of Iron Bridges generally, and of Iron Ships.

Among the many important advantages of the PATENT FERRUGINOUS CEMENT PACKING, are, Indestructibility by either Fire, Steam, Water, or Gas; Instant and Ready Application; and great Economy of Time and Labour by its use for Joints, &c., in place of the ordinary Iron Cement. For all Permanent Joints it can be made to set as hard as Iron, and it will Expand and Contract in the same ratio as the metal itself. For all other Joints it can be made sufficiently elastic for the purposes to which India-rubber or other Packing is applied.

WILLIAM WARNE and CO.,
India-rubber Manufacturers, 9 Gresham-street West, E.C.
MILLS—Tottenham, N. (360)

RICHARD BAIRD, GENERAL COMMISSION AGENT, and CONTRACTOR for all descriptions of RAILWAY PLANT and STORES.
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TO RAILWAY COMPANIES, ENGINEERS, MILL-OWNERS, &c., &c.

THE PATENT PLUMBAGO CRUCIBLE COMPANY draw the attention of all Owners of Machinery to their fine POWDERED PURE FLOUR PLUMBAGO, which they can confidently recommend for Anti-friction purposes, being an impalpable powder, and warranted perfectly free from grit and any impurity.

For ordinary polishing purposes it will be found superior to any Black Leads offered.

Price £27 10s. per ton, £1 10s. per cwt.; samples of 28 lbs. forwarded on receipt of 8s. Packages free.

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BALLOONS or Boats Driven by Steam.—The common opinion that Balloons will never be practicable for general travelling is erroneous—the action of Parker's Small Steam Boats shows that they may be propelled at great speed; the Boats are driven by Steam Rockets, which act upon the air. Fuel, a few drops of spirits; Boats complete, 5 in. for a basin, 3s. post free; 13 in. for ponds, 5s. 6d. rail free.

JAMES PARKER, Inventor, 6 Lilford-road, Camberwell.

These Small Boats go twice the speed of any others with half the fuel; a Steel Rocket of 150 lbs., steam pressure, 1,000 lbs. (1-20th of gunpowder) would drive a Cylindrical Balloon—with pointed ends, capable of carrying one passenger—ten miles per hour. (350)

MACHINERY of all Kinds DRAWN and ENGRAVED on WOOD, with the greatest accuracy of detail and Artistic Effect, by
L. WALMSLEY,
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Artists sent to all parts of the United Kingdom, if required. (343)

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J. BLOOMFIELD,

MAKER OF

WORKING SECTIONAL MODELS OF STEAM ENGINES, IN WOOD OR METAL,

10½ ST. JAMES'S PLACE, HAMPSTEAD ROAD.

Mr. BLOOMFIELD, having had many years' experience in making models for the late firm of Watkins and Hill, of Charing-cross, can confidently guarantee accuracy of workmanship at very reasonable charges. (329)

INDIA-RUBBER VALVES FOR STEAM ENGINES, PUMP PACKING, &c.—Explanatory Drawings and Information as to the best modes of fitting and arranging the above, and all other Mechanical Applications of VULCANISED INDIA-RUBBER, are furnished post-free by

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MANUFACTORY and DEPÔT, Cambridge-st., Manchester.
GENERAL WAREHOUSE, 3 Cannon-street West, London, E.C.—C. M. and Co.'s only Establishments. (139

ISCA FOUNDRY COMPANY, OLD BARRACKS, NEWPORT, MON.
ENGINEERS, AND RAILWAY WAGGON BUILDERS.
Manufacturers of Switches, Points, and Crossings, Chairs, Spikes, Bolts, and General Railway Fittings. (279)

TO MANUFACTURERS, THE ENGINEERING, MECHANICAL, & BUILDING TRADES GENERALLY.

MESSRS. BOOTH & CO., AUCTIONEERS and BUILDERS' SALESMEN, having opened Registers for Public and Private Sales of all kinds of JOB LOTS, Surplus Stock, Stores, Tools, Implements, &c., &c., (either Old or New,) beg to call the attention of all parties to the only medium established of the kind, and to state that they are prepared to receive consignments of any weight, bulk, or value, and of any class of Goods for immediate Sale. Full particulars may be had for two stamps, at the BUILDING TRADES REGISTRY OFFICES, (established 1857,) 13 EASTCHEAP, LONDON, E.C. The Public Sales by Auction are held Weekly, on EVERY TUESDAY, at ONE O'CLOCK, and for the present at the BUILDERS' SALE GROUNDS, (established 1858,) 23 and 24 MARYLEBONE ROAD, REGENT'S PARK, W. Catalogues by Post for One Stamp. Advances on New Goods. All communications are held private and confidential. (204)

THE IMPERIAL IRON TUBE COMPANY (Successors to GEORGE B. LLOYD and Co.),
Gas-street and Berkley-street, Birmingham,
Manufacturers of Wrought Iron Tubes and Fittings, for Gas, Steam, and Water. Patent Glass-Enamelled and Galvanised Tubes, and Lap-welded Iron Boiler Tubes. 347)

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SCOTT'S
PATENT GRASS-SEED SEPARATOR,

which entirely extracts the Seeds of "COUCH," "TWITCH," "SPEAR," or "HAIR" GRASS and other impurities from

PERENNIAL AND ITALIAN RYE-GRASS, &c.,

AND

SCOTT'S PATENT CARROT SEED BEARDING

AND

CLOVER AND TREFOIL MILLING OR DRAWING MACHINE,

which effectually removes the beard from Carrot Seed, rendering it fit for sowing with facility by drill or otherwise, and by the separation of abortive or diseased grains vastly increases its vegetative per centage. By a slight modification it is applicable to the other purposes before mentioned.

These Machines were admittedly the most novel, and, at the same time, the most useful and important to the Farmer of any exhibited at the late SMITHFIELD CLUB SHOW.

They may be seen at work at the Establishment of the Manufacturer,

Mr. T. MIDDLETON, Engineer, Southwark.

Communications to be sent to the Patentee, J. SCOTT, 111 Drummond Street, Euston Square London, N.W. 4

CLAYTON, SHUTTLEWORTH, AND CO.,

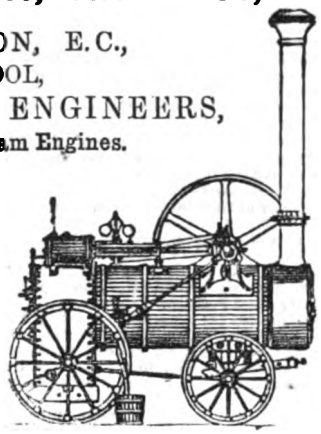
OF LINCOLN,

78 LOMBARD STREET, LONDON, E.C.,

AND 36 DALE STREET, LIVERPOOL,

AGRICULTURAL AND GENERAL ENGINEERS,

And Manufacturers of Portable and Fixed Steam Engines.



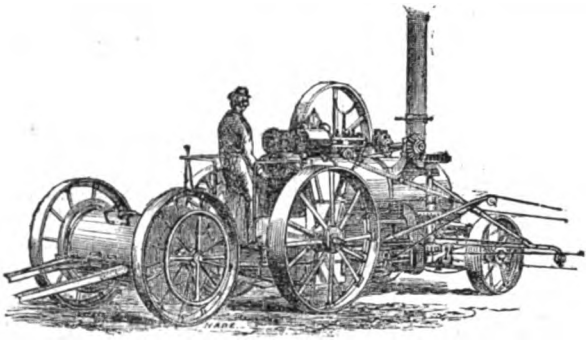
Combined Threshing Machines, which dress the corn ready for market at one operation. Grinding Mills, Saw Benches, Pumps for Irrigation and Mining purposes, with all necessary gearing for being driven by steam power. Full particulars and estimates given on application to the above address.

C. S. and Co.'s PORTABLE STEAM ENGINES are adapted for every purpose to which steam-power can be applied. When intended for winding, they are fitted with reversible link motion and winding gear. They are easy of removal, as may be seen by the engraving, and can be set to work immediately on arrival.

C. S. and Co. are now doing an extensive foreign and colonial business, and are prepared to send off engines and machinery of the before-mentioned kinds in a few days from the date of order. They would also call attention to the important *reduction in prices* made for the new year.

For Exportation.—The above can be obtained through British Merchants, Shippers, and Colonial Agents. (23)

FOWLER'S PATENT STEAM PLOUGH.



The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching Plough, and Scarifier.

For further particulars, Illustrated Catalogues, and Prices, apply to

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VOKINS & HURD,

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HOT-HOUSE BUILDERS

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Hot-Water Apparatus Manufacturers.

Plans and Estimates forwarded on Application. (149)

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THE

SILVERTOWN INDIA-RUBBER WORKS

OPPOSITE

H. M. DOCKYARD, WOOLWICH.

INDIA-RUBBER MANUFACTURES

WITH ALL

RECENT IMPROVEMENTS.

Warehouses, 3 and 4 Bishopsgate Within, E.C. (145)

WATER GLASS, or SOLUBLE SILICATES of SODA or POTASH, in large or small quantities, and either Solid or in Solution, at

ROBERT RUMNEY'S, Ardwick Chemical Works, Manchester. (335)

DRAUGHTS of COLD AIR and DUST round Room, Office, or outside Doors and Windows EFFECTUALLY PREVENTED by GREENWOOD'S PATENT INDIA-RUBBER STOPS, the most simple and effectual method of making air-tight joints to joiners' or cabinet work, old or new. These Stops can be had any length or pattern. Self-acting Spring Stops, for the bottoms of doors.

The Trade supplied.

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PATENT METALLIC STEAM GAUGES.

THESE GAUGES have been in use more than three years, and have given general satisfaction. Those first fixed are now in as good working condition as ever. Testimonials, &c., may be seen at CHADBURN BROS.' Works, Sheffield.

The Gauges may be had of all respectable Ironmongers in the country. (286)

SMALL GAS APPARATUS, WITH FREEDOM FROM NUISANCE.

THE PATENT NATIONAL COAL-GAS APPARATUS,

FOR

Private Residences, Farm Buildings, Churches, Chapels, Railway Stations,

And all isolated places not yet lighted with Gas.

The various parts are of the best materials and workmanship, are not liable to get out of order, and can be worked with a small degree of attention by a farm-servant or labourer without materially interfering with his other duties.

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J. T. B. PORTER and CO., Lincoln. (346)

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AN Engineer of much Experience can give Assistance in Practically Arranging Inventions, contriving Machinery, Preparing Drawings Tracings, &c. Address, M. E., 9 Parliament-street, Westminster. (304)

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WILLIAM DRAY and COMPANY, Agricultural and General Engineers, &c., Adelaide Place, London Bridge, invite attention to their new Central Premises, close to London Bridge, where may be seen their celebrated Champion Reaper, Chaff Engines, Oat Bruisers, Post Mills, Pumps, Weighing Machines, Corn Bins, their Patent Self-Adjusting Scythe, Garden Engines, Handsome Garden Seats, Lawn Mowers (every make), Flower Stands, and Garden Tools of all descriptions.

NOTE.—Descriptive Catalogues of any particular class of Implements forwarded post free upon application. (318)

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RICHARD GARRETT AND SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

Beg respectfully to call attention to their

NEWLY-INVENTED "FIXED" AND "PORTABLE" COMBINED FINISHING, THRASHING, AND DRESSING MACHINES.

THESE MACHINES have been but recently introduced, and are adapted for preparing all kinds of Grain quite fit or market, in a thoroughly efficient manner. The points in which these new Machines more particularly excel may be stated as follows:

1st. Their compactness; being fully one-third less in size and bulk than the ordinary Machines hitherto in use for the same purpose.

2nd. The great reduction in the number of wearing parts. In these Improved Machines more than one-half the spindles, pulleys, bearings, and driving belts required for the ordinary Machines are dispensed with.

3rd. The novel arrangement by which the Dressing Apparatus is instantly varied, while the Machine is at work, to suit all kinds and conditions of grain.

4th. The very important saving in the cost of keeping the Machines in working order, consequent on the great reduction in the number of wearing parts.

N.B.—Catalogues in English, French, or German can be obtained FREE, on application being made to R. G. & SONS, at

LEISTON WORKS, SAXMUNDHAM, SUFFOLK. 314

IMPROVED MACHINERY FOR AGRICULTURISTS.

RICHARD GARRETT & SONS,

LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

(ESTABLISHED A.D. 1778),

EARNESTLY solicit the continued support of their numerous Friends, Agriculturists, Shippers, and others; the additions made to their Works during the present year, in the erection of new sets of Workshops, fitted with the best mechanical appliances for producing Machinery of the most improved construction, expeditiously and economically, justifies their soliciting increased support, while their leading reputation as Inventors and Manufacturers of FIRST CLASS Agricultural Machinery, is a sufficient guarantee that every Machine supplied from Leiston Works will prove to the entire satisfaction of the purchaser.

R. G. & S. are now manufacturing the following Machines and Implements, which they guarantee to be thoroughly efficient in every respect:—

PORTABLE AND FIXED STEAM ENGINES. } From 4 to 40 Horse Power, suited for every kind of work
SELF-PROPELLING AND TRACTION ENGINES. } to which Steam Power is applied.
STONE GRINDING MILLS.
MORTAR AND PUG MILLS.
MILLWRIGHTS' WORK of all kinds.
SAWING MACHINERY, from 4 to 20 Horse Power.
BRICK AND TILE MACHINES.

IMPROVED SETS OF FARM MACHINERY, for Large Occupations.
PORTABLE AND FIXED MACHINERY, for Thrashing and Dressing Corn.
THE PRIZE BOLTING AND OPEN-DRUM HORSE-POWER THRASHING MACHINES.
CORN DRESSING MACHINES, for Hand, Horse, Water, and Steam Power.
BARLEY AVELLING MACHINES.
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PATENT TURNIP CUTTING AND PULPING MACHINES.

THE PRIZE CORN AND SEED DRILLS.
PRIZE CORN AND SEED DRILLS WITH MANURE APPARATUS.
PRIZE SEED AND MANURE DRILLS.
LIQUID, SEED, AND MANURE DROP DRILLS.
CHAMBER'S PATENT BROADCAST MANURE DISTRIBUTOR.
GARRETT'S PATENT HORSE HOE for all Crops.
PATENT REVOLVING HOES for Root Crops.
IMPROVED PLOUGHS AND REAPING MACHINES.
&c. &c. &c.

Of which full detailed particulars will be found in R. G. & SONS' ILLUSTRATED CATALOGUE, sent postage free to any address, in English, French, or German; and any of the above Machines will be shown in operation at R. G. & Sons' Farm, near the Works, on their receiving a few days' notice.

A Copy of R. G. & SONS' new COLONIAL LIST will be forwarded free to any of the Colonies, and Shippers will be supplied with these lists, with their names and addresses printed on, free of charge, by making application for the same.

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MOST VALUABLE ASSISTANCE will be rendered to persons in the above position; or to such as may be desirous of arranging privately with Creditors. There are thousands of persons who have struggled long against the force of misfortune, but few are aware that by a recent Act all small traders owing debts not exceeding £300, can be entirely raised from their difficulties, in all cases without imprisonment; and, if necessary, cash advanced for the above purpose.

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STEAM BALLOONS.—Much more propelling power is obtained by Steam Rockets than by the Marine Engine from same amount of fuel. At low pressure little Rocket Boats go twice as quick as any others with half the fuel. At great pressure the propelling power is equal to one-third the whole weight of the engine, and thus is solved the problem of aërial navigation by steam balloons. Small boats complete, (pretty interesting toys) 4½ in. for lake tray, 3s.; 13 in. for ponds, 5s. 6d.; both rail free, James Parker, Inventor, 6 Lilford Road, Camberwell. Fuel, a few drops of spirits. Steam up in half-a-minute, and lasts five. (353)

ESTABLISHED 1700.

WINDOW BLINDS.—GEO. F. JANES and CO., Wholesale, Retail, and Export Window Blind Manufacturers, 29 Finsbury-place, and 9, 10, and 11 Cross-street, Finsbury. Estimates given and executed with despatch. Experienced Workmen sent to any part of the kingdom. (355)

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PATENT LEVER BREAKS for RAILWAY WAGGONS, doing away with the objectionable Break Rack. Can be applied to existing stock at a trifling expense. Royalty moderate.

Models can be seen at 34 Great George-street, Westminster, and the Breaks in action at the Works of the Railway Carriage Company at the Peterborough Station, on the Eastern Counties Railway; the Rugby Station, London and North-Western Railway; the Cardiff Docks Station, Taff Vale Railway; and at the Works, Oldbury, near Birmingham, where all communications are requested to be sent. (275)

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CONDY'S PATENT PURE CONCENTRATED MALT VINEGAR.

Families, by using this delicious VINEGAR, insure purity and effect a saving of 50 per cent. See "Report of Dr. Letheby, City Officer of Health, Dr. Hassall, of the 'Lancet' Commission, and others." Sold by the Trade, in Bottles, labelled and capsuled. Wholesale—63 King William-street, London-bridge, E.C. Six Quart Samples sent free to any Railway for 3s. 6d. (216)

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Hot-Water Apparatus for Conservatories, &c., on the most economical and improved principles.

Also Manufactory for Captain John Grant's much improved Cooking Apparatus. (44)

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Are prepared to ESTIMATE FOR and CONSTRUCT BRIDGES, PIERS, JETTIES, &c., in Iron, Wood, or Stone. Also to supply Cranes, Girders, Turntables, and Railway Work and Plant generally. (199)

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LOCOMOTIVE TYRE-BARS of every description for Engines, Carriages, and Railway Waggon Wheels.
STEEL-IRON for Springs. MERCHANT and other Irons manufactured. WM. F. HOYLE, Proprietor. (278

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IRON SHIPS may be rendered FIRE-PROOF if internally fitted with Fibrous Slab in lieu of Deal.

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EMIGRATION TO NEW YORK. CANADA, AUSTRALIA, NEW ZEALAND, EAST INDIES, CAPE OF GOOD HOPE, &c. All Classes of Passengers booked throughout in the Finest Steam and Sailing Packets. Full Particulars in our circulars for 1859, may be had gratis on application to F. S. GRAY and Co., 54 King William Street, City, and 6 Tower Hill, London; and at 35 Bath Street, Liverpool. (187)

FUEL AND STEAM ECONOMY.—Apply to Mr. LEE STEVENS, C.E., 1 Fish-street-hill, E.C. 243

CONDY'S PATENT FLUID, or NATURAL DISINFECTANT.

Not only Deodorizes but Disinfects perfectly, and DESTROYS FOR EVER the cause of infection.

Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.

This fluid has been examined and reported upon by the Board of Health, all the most eminent Men and Chemists of the day, in all cases in the most satisfactory manner possible.

The Public are recommended to use this Fluid, properly diluted with water, frequently and habitually in larders, sculleries, dairies, musty cakes, sick rooms, close places, &c., as it has numerous advantages, and can be used with certain immediate success and perfect safety.

Sold in Quart Bottles, 4s.; Pints, 2s.; Half-pints, 1s. and in bulk, 10s. per Gallon.

Free to Railway on receipt of Order or Stamps. (238)

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THE IMPERIAL IRON TUBE COMPANY,

(SUCCESSORS TO GEORGE B. LLOYD & CO.)

GAS STREET AND BERKLEY STREET,

BIRMINGHAM.

Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES.

(193)

JOHN WARNER AND SONS,

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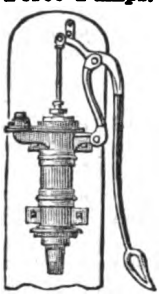
HYDRAULIC ENGINEERS, BRASS AND BELL FOUNDERS,

PATENTEES OF IMPROVEMENTS IN PUMPS.

Patent Vibrating Standard Lift and Force Pumps.



PATENT CAST-IRON PUMP fitted with J. Warner and Sons' Patent Bucket and Sucker, which cannot clog in action, for Farms, Cottages, and Wells, not exceeding 28 feet.

Dia.	Height.	£ s.
2½ in. short	1 ft. 7 in.	1 10
2½ in. long	3 ,, 3 ,,	1 14
3 ,,	6 ,, 6 ,,	2 8
3½ ,,	3 ,, 6 ,,	3 3
4 ,,	3 ,, 6 ,,	3 3
4½ ,,	3 ,, 6 ,,	3 3
2½ in. short, with 15 feet of Lead Pipe attached, ready for fixing		2 14
2½ in. long. do. do.		2 18

PATENT BRASS LIFT AND FORCE PUMP, on Plank, for House purposes, supply of Cisterns, &c.

	£ s.
2½ inch	6 0
3 ,,	7 5
3½ ,,	8 0

A lighter Pump of 3 inches diameter, can be supplied if required 5 15

IMPROVED LIQUID MANURE OR GENERAL PORTABLE PUMP.

These Pumps are fitted with J. Warner and Son's Patent Bucket and Sucker, and cannot clog in action. The Barrel is of Galvanized Iron, not likely to corrode, and can be raised or lowered at pleasure. The legs will fold together, and the whole may be carried on shoulder to any pond or tank required.

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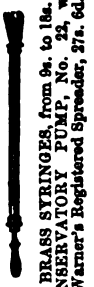

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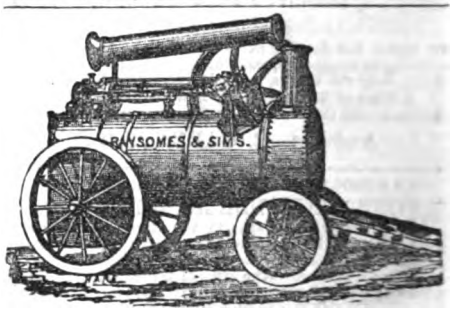

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IPSWICH,

AGRICULTURAL & GENERAL ENGINEERS

AND

IRONFOUNDERS.

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(165)

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

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A COURSE OF SIX LECTURES ON SOCIAL SCIENCE as a branch of School Instruction, especially addressed to Teachers, will be delivered in the Lecture Theatre, South Kensington, by William Ellis, on Tuesday evenings, the 11th, 18th, 25th October; 1st, 8th, and 15th November, 1859; at eight o'clock.

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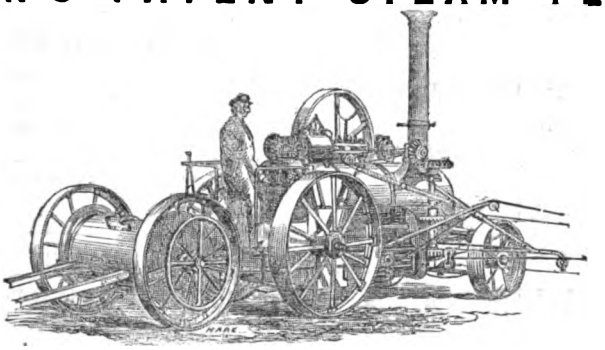

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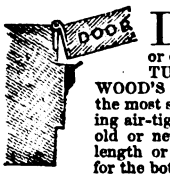

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TIN:									
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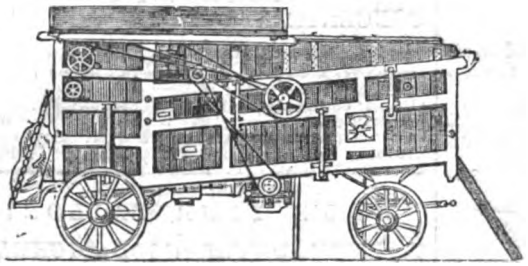

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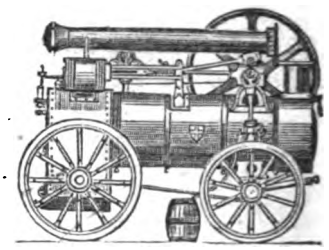

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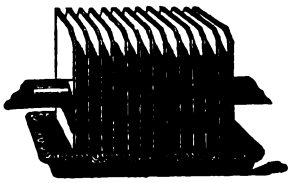

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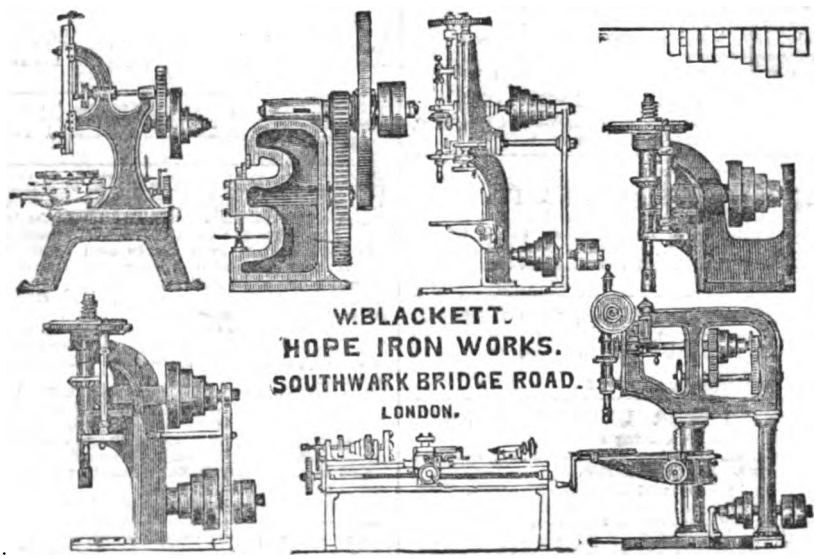

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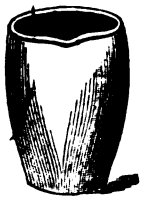

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 44. [NEW SERIES.]

LONDON: FRIDAY EVENING, OCTOBER 28, 1859.

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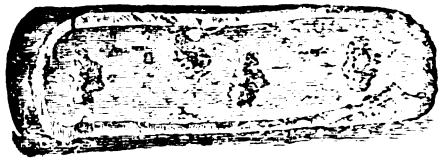

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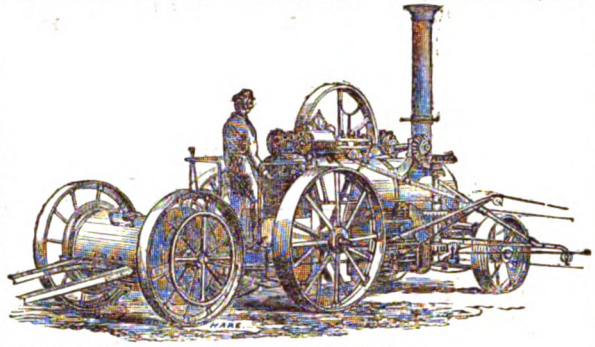

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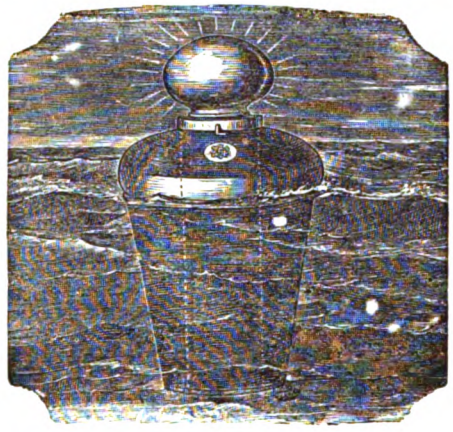

The RECORD BUOY is intended to be kept in some place available for instant use, and to be thrown overboard from a sinking ship, or a Vessel on Fire, so as to intimate disaster, having a paper inserted therein, already filled up with the Ship's Name, Port of Registry, Official Number, &c., and a few last words hastily written, intimating the nature of the calamity, with any further information that can be given at such a time. It has capacity and buoyancy to contain besides these, the Log Book, and several pounds' weight of Papers or Valuables. It is lined with Cork between the Cylinder and outside case, so that, although waterlogged, it will not sink, but keep afloat for a long time, probably for years.

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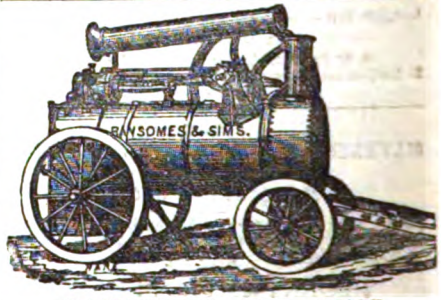

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 45. [NEW SERIES.]

LONDON: FRIDAY EVENING, NOVEMBER 4, 1859.

PRICE, FOURPENCE. BY POST 5d.

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TO MACHINE MAKERS, BRICK AND TILE MAKERS.

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Preston, Lancashire, October 21st, 1859. (382)

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TO BE LET, an Iron Foundry, with a connection for (Patenteed) Plain Castings, and with or without a small Brass Foundry. To a practical moulder with a small capital this is a good opening. For further particulars address "Alpha," Deacon's News-room, Leadenhall-street, E.C. (386)

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This Float combines extreme sensitiveness with simplicity; it also acts as an Alarum when the water falls low in the boiler. For a description, with Engravings, see the MECHANICS' MAGAZINE for October 28th. Testimonials have been given as to their efficiency by many eminent Engineers, and they are not expensive. For further particulars apply to the Patentee, whose works are at No. 58 Oxford-street, Birmingham; or Mr. J. W. Wilson, Civil and Mechanical Consulting Engineer, 9 Buckingham-street, Strand, London, where they also may be seen. (377)

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STEAM BOILERS.—The Patentee of an Improvement in Cornish Boilers wishes to meet with a Boiler-builder who would try some inexpensive experiments, in consideration of receiving one-third share of the Patent, which may prove of considerable value. Address, "Alpha," office of this Paper. (388)

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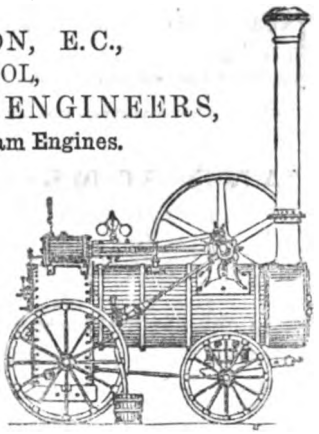

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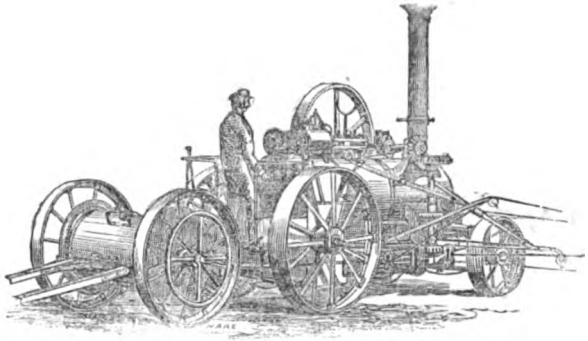

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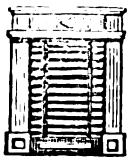

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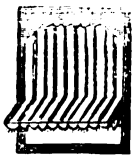

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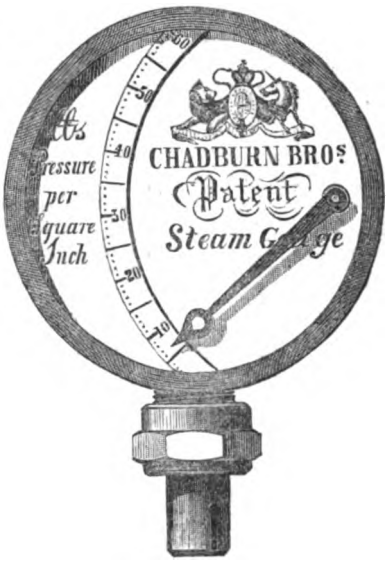

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PRICES CURRENT OF METALS.

London, Nov. 4th, 1859.

		£	s.	d.		£	s.	d.	Dis. p.ct.
IRON:									
Rails in Wales and North of England	pr.ton	6	0	0	to	6	5	0	nett
Welsh Bars, in Wales	„	5	17	6	„	6	0	0	3
Staf. Bars, at the Works	„	7	0	0	„	7	10	0	2½
„ Hoops	„	8	0	0	„	8	10	0	„
„ Sheets, Singles	„	8	10	0	„	9	0	0	„
„ Nail Rods	„	7	0	0	„	7	10	0	„
„ Boiler Plates	„	8	10	0	„	9	0	0	„
Scotch Pig, M. Nos., Warrants, at Glasgow	„	2	11	3	„	2	11	6	nett
Do. No. 1, Good Brands	„	2	11	9	„	2	14	0	„
Scots Bars	„	7	10	0	„	8	0	0	3
Swedish Bars, in London	„	11	10	0	„	11	15	0	2½
COPPER:									
Sheet and Sheathing	per lb.	0	0	12	„	0	0	0	3
Tough Cake and Tile	pr.ton	107	10	0	„	0	0	0	
Best Selected	„	110	10	0	„	0	0	0	„
Australian	„	109	0	0	„	109	10	0	„
South American	„	99	0	0	„	101	0	0	nom
Yellow Metal Sheathing	per lb.	0	0	10	„	0	0	0	„
STEEL:									
Swedish Keg	pr.ton	19	0	0	„	19	5	0	2½
„ Faggot	„	21	0	0	„	21	10	0	„
TIN:									
English, Block	p. cwt.	6	12	0	„	0	0	0	2½
„ Bar	„	6	17	0	„	0	0	0	„
Foreign, Banca	„	6	15	0	„	6	18	0	nett
„ Straits	„	6	10	0	„	6	15	0	„
TINPLATES:									
Charcoal, I.C.	pr.box	1	11	0	„	1	12	0	3
Coke, I.C.	„	1	5	0	„	1	5	6	„
LEAD:									
Pig, English	pr.ton	22	5	0	„	22	10	0	2½
„ Spanish	„	21	10	0	„	22	5	0	„
Sheet	„	23	0	0	„	23	5	0	„
SPELTER:									
On the spot	„	20	15	0	„	20	17	6	nett
For arrival	„	20	15	0	„	20	17	6	„
ZINC:									
English Sheet	„	27	0	0	„	0	0	0	1½
QUICKSILVER	pr.btl.	7	0	0	„	0	0	0	1½

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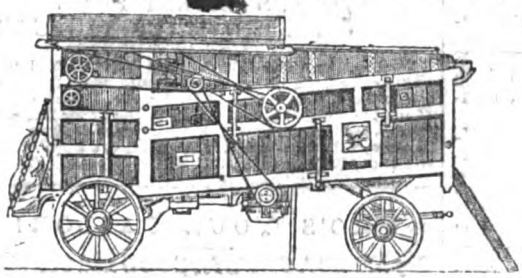

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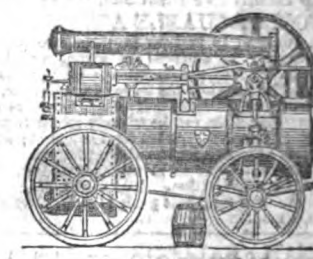

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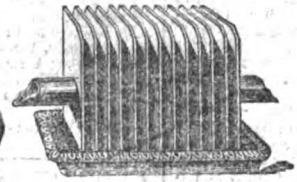

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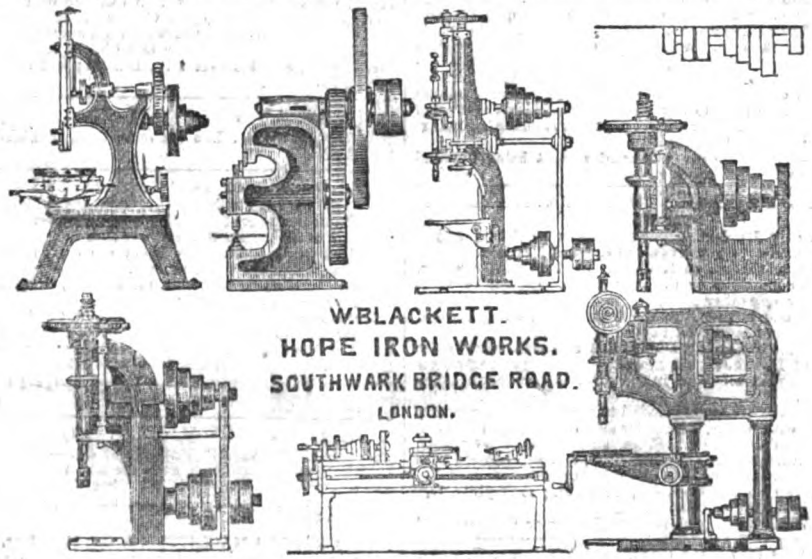

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 46. [NEW SERIES.]

LONDON: FRIDAY EVENING, NOVEMBER 11, 1859.

PRICE, FOURPENCE. BY POST 5d.

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These Counters egister the number of revolutions made by an engine or other mechanism. They may be used for ascertaining the duty of Pumping Engines and Water-wheels; the revolutions on board a steam-vessel; to calculate the slip of the propeller; and in a locomotive to test the slip of the wheels.

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THE IMPERIAL IRON TUBE COMPANY (Successors to GEORGE B. LLOYD and Co.), Gas-street and Berkley-street, Birmingham, Manufacturers of Wrought Iron Tubes and Fittings for Gas, Steam, and Water. Patent Glass-Enamelled Galvanised Tubes, and Lap-welded Iron Boiler ... and ...oes. 347)

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AND PATENT AGENTS,

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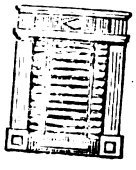

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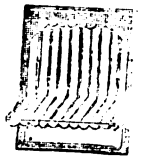

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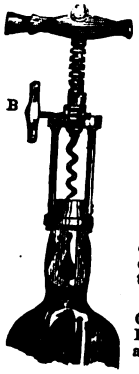

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LONDON RACK CORK

SCREWS

on the neck of a bottle, and it is ready for use. Some of these Cork Screws are fitted with Patent Spring Ends to embrace the neck of the bottle, and so direct the worm through the centre of the cork.

Sold by the Patentee at 56 and 57 Cornhill, and 23 and 24 Fleet-street, London; and may be had at all Cutlers' and Ironmongers'. (254)

Important to every man who keeps

THORLEY'S FOOD FOR CATTLE,

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Price 50*s. per Cask, containing* 448 *lbs.*

Carriage paid to any Station.

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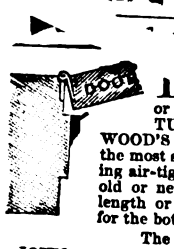

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SMITH'S PATENT DOOR SPRINGS,

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and that Springs thus marked are warranted.

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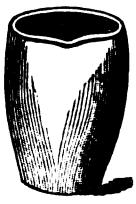
[illegible]tted by all to be the most perfect invention for the purpose. are [illegible]dm. Diagrams and List of Prices on application. (195

TO BRASS-FOUNDERS, ENGINEERS, &c.



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NOTE.—Descriptive Catalogues of any particular class of Implements forwarded post free upon application. (316)

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TO MECHANICS.

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WILCOX and Co., Millwall Pottery Company.

These Tubes are superior to all others; being a clear white, no mistake can arise in working. Guaranteed to stand a pressure of 500 lb.

Extensively used on all the principal lines.

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Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.

This fluid has been examined and reported upon by the Board of Health, all the most eminent Men and Chemists of the day, in all cases in the most satisfactory manner possible.

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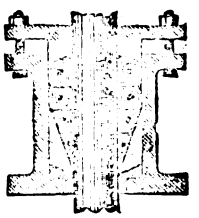

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WHEN YOU ASK FOR

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GAS STREET AND BERKLEY STREET,

BIRMINGHAM.

Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES.

(193)

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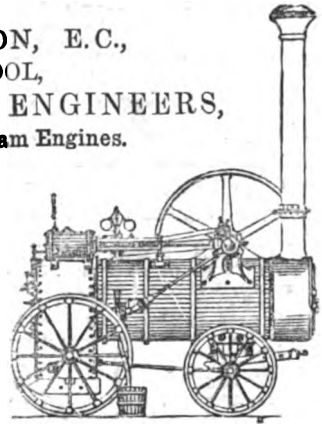
AGRICULTURAL AND GENERAL ENGINEERS,

And Manufacturers of Portable and Fixed Steam Engines.



Combined Threshing Machines, which dress the corn ready for market at one operation. Grinding Mills, Saw Benches, Pumps for Irrigation and Mining purposes, with all necessary gearing for being driven by steam power. Full particulars and estimates given on application to the above address.

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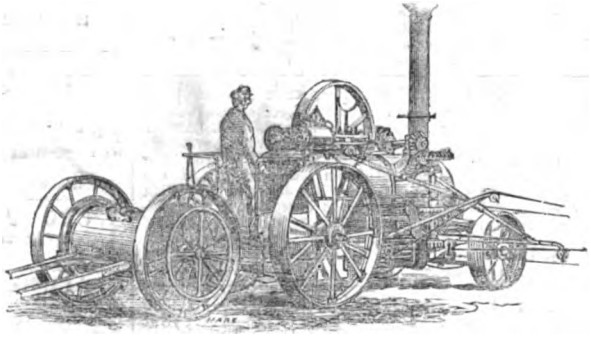
ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching-Plough, and Scarifier.



The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

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(388)

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NEWLY-INVENTED "FIXED" AND "PORTABLE" COMBINED FINISHING, THRASHING, AND DRESSING MACHINES.

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WATER POISONED BY LEADEN PIPES.

"The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight. The water has cut these deep pits almost through the pipe, and not only upon the portion which we have illustrated, but has formed similar chasms throughout the entire length."—*Expositor.*

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"My private house, which was supplied with your Gutta Percha Tubing some five or six years ago, has never required the slightest attention; and previously, there was no winter passed that we were not deluged in consequence of the bursting of the leaden pipes."

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Every Variety of Gutta Percha Article.

SUCH AS

Mill-bands,	Flasks,
Tubing for Watering Gardens, &c., &c.,	Bowls,
Soles,	Chamber-vessels,
Sheet,	Galvanic Batteries,
Pump-buckets,	Toilet-trays,
Fire-buckets,	Sponge-bags,
Bottles,	Curtain-rings,
Bosses,	Talbotype-trays,
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The Gutta Percha Company, Patentees,

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(54)

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 47. [NEW SERIES.]

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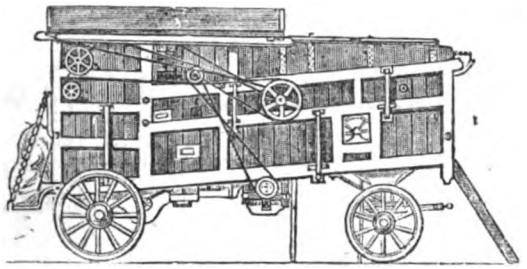

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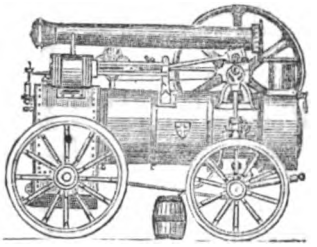

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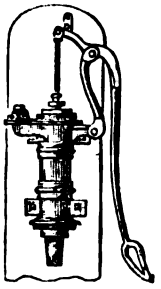

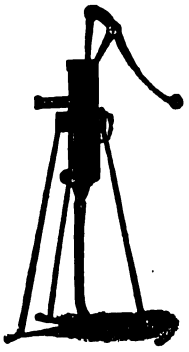

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2½ in. long	3 ,, 3 ,,	1	10
3 ,,	3 ,, 6 ,,	2	4
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4 ,,	3 ,, 6 ,,	2	18

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2½ in. long. do. do. 2 14

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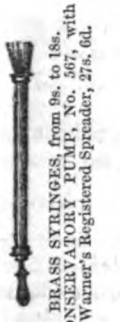

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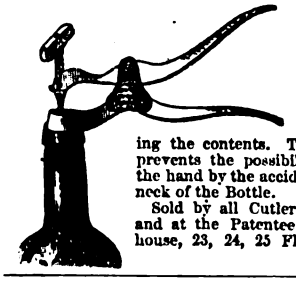

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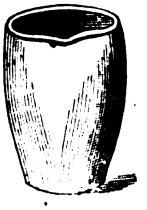

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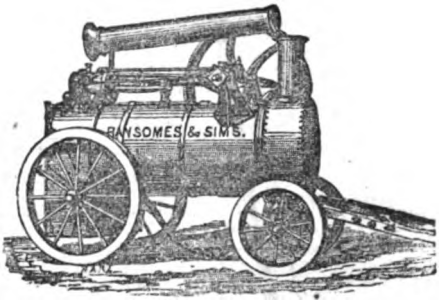

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INVENTORS, ENGINEERS, AND OTHERS.

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By Royal Letters Patent.

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Call the particular attention of

SHIP-OWNERS, SHIP-BUILDERS, AND COMMANDERS OF STEAM AND SAILING VESSELS,

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These Pumps are free from that liability to choke which is common to other Pumps, and their Working Parts are not susceptible of derangement either from wear or from being long out of use. They pass entirely through them, with ease, any substance that may enter the Suction Pipes. The Novelties in these Pumps are their adaptation to the varied duties of Ships' Pumps, the facilities they afford for Cleansing the Suction Pipes, and for Sounding or Examining the Valves; the readiness with which they may be used for Ventilating the Bilge, or for acting as a Syphon either for Watering the Ship, or for extinguishing Accidental Fires on board: the rapidity with which they can be converted into Fire Pumps, or be applied to the Washing of Decks; and their capability of Pumping from Several Compartments. Also, to their

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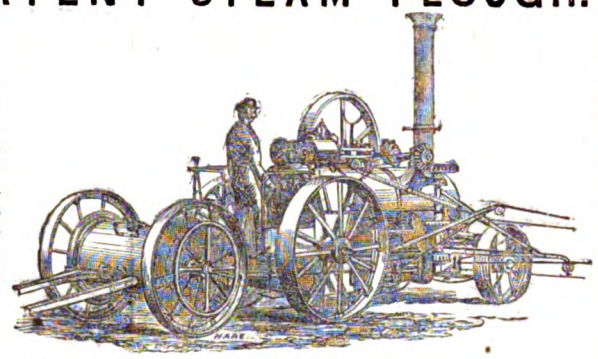

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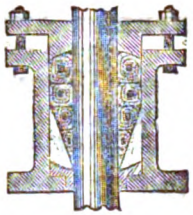

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BALLOONS or Boats Driven by Steam.—The common opinion that Balloons will never be practicable for general travelling is erroneous—the action of Parker's Small Steam Boats shows that they may be propelled at great speed; the Boats are driven by Steam Rockets, which act upon the air. Fuel, a few drops of spirits; Boats complete, 5 in. for a basin, 3s. post free; 13 in. for ponds, 5s. 6d. rail free.

JAMES PARKER, Inventor, 6 Lilford-road, Camberwell.

These Small Boats go twice the speed of any others with half the fuel; a Steel Rocket of 150 lbs., steam pressure, 1,000 lbs. (1-20th of gunpowder) would drive a Cylindrical Balloon—with pointed ends, capable of carrying one passenger—ten miles per hour. (350)

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AND

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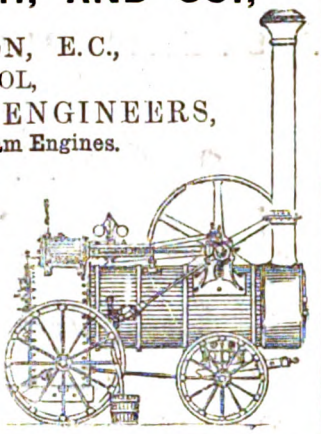

Combined Threshing Machines, which dress the corn ready for market at one operation. Grinding Mills, Saw Benches, Pumps for Irrigation and Mining purposes, with all necessary gearing for being driven by steam power. Full particulars and estimates given on application to the above address.

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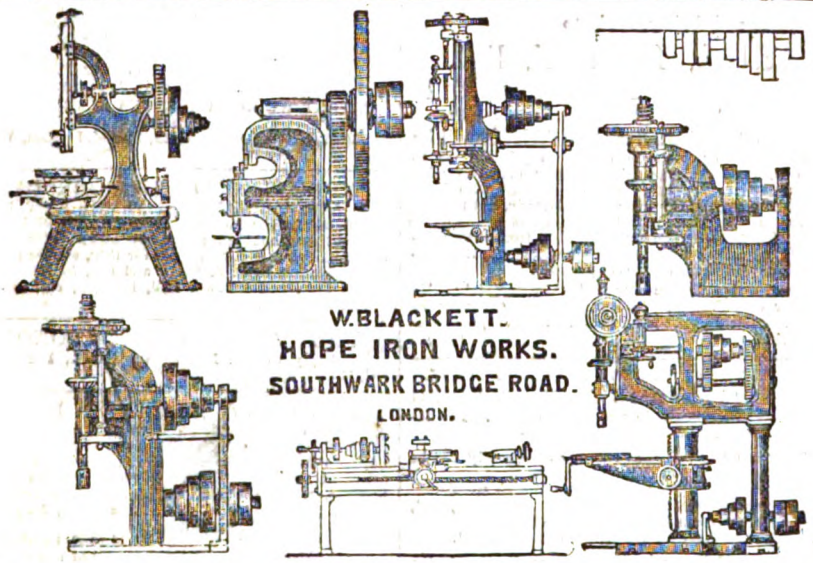

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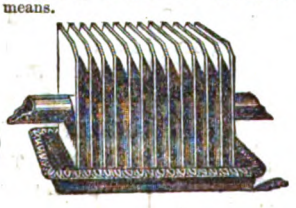
Steam, Hot-water, Gas, and in open or enclosed fireplaces, Coal and Coke are equally available for the process.

The cost is less and the effect greater than that of any other known means.



The Horticulturist will find herein an instrument of new and important powers.

The apparatus may be seen in ST. PAUL'S CATHEDRAL, the various offices of the "Department of Science and Art," and in many churches and other buildings.

Particulars and Testimonials forwarded on application. (12

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GUTTA PERCHA MILL BANDS.

THE GUTTA PERCHA COMPANY beg to state that the increasing demand for the Gutta Percha Strapping for Driving-bands, Lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

Their durability and strength—permanent contractability and uniformity of substance—their non-susceptibility of injury from contact with oils, grease, acids, alkalies, or water—and the facility with which the only joint required can be made in bands of from 200 to 300 feet long—render them superior to leather for almost all working purposes, and decidedly more economical.

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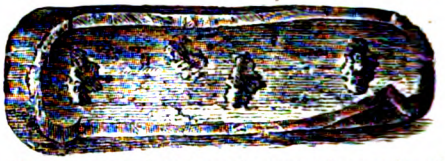
WATER POISONED BY LEADEN PIPES.



The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight.

POISONED WATER PREVENTABLE

BY THE USE OF GUTTA PERCHA TUBING.

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(28)

Published by RICHARD ARCHIBALD BROOMAN, at the MECHANICS' MAGAZINE Office, 166 Fleet-street, in the Parish of St. Dunstan's-in-the-West, in the County of Middlesex; and printed by JAMES JUDD, of 14 Holford-square, Pentonville, in the County of Middlesex, and HENRY ALEXANDER GLASS, at their Office, 38A New Bridge-street, in the Parish of St. Anne's Blackfriar in the City of London.—Friday, November 18, 1859.

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 48. [NEW SERIES.]

LONDON: FRIDAY EVENING, NOVEMBER 25, 1859.

PRICE, FOURPENCE. BY POST 5d.

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WELLS & HALL are prepared to Insulate Conductors of all sizes for Submarine Cables or any other purpose where Insulation is required for Telegraphic Communication. The insulating medium is pure india rubber applied by their patent machinery.

HALL & WELLS, Patentees, Steam Mills, Mansfield street, Borough-road, Southwark, S.E. (362)

TO WIRE ROPE MAKERS.—ARCHIBALD SMITH is now prepared to GRANT LICENCES for the use of his PATENT ROPE MACHINERY, guaranteed to work at six times the speed of any other, and to save upwards of fifty per cent. in the cost of making. It is used by the most eminent makers, and was also in the manufacture of the Atlantic Cable.—Apply to 69 Princes-street, Leicester-square, W. (198)

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"MECHANICS' MAGAZINE" & PATENT OFFICE,

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PRICES CURRENT OF METALS.

London, Nov. 25th, 1859.

		£ s. d.		£ s. d.	Dis. p.ct.
IRON:					
Rails in Wales and North of England	pr.ton	6 0 0	to	6 5 0	nett
Welsh Bars, in Wales	"	5 17 6	"	6 0 0	3
Staf. Bars, at the Works	"	7 0 0	"	7 10 0	2½
" Hoops	"	8 0 0	"	8 10 0	"
" Sheets, Singles	"	8 10 0	"	9 0 0	"
" Nail Rods	"	7 0 0	"	7 10 0	"
" Boiler Plates	"	8 10 0	"	9 0 0	"
Scotch Pig, M.Nos. Warrants, at Glasgow	"	2 13 0	"	2 13 3	nett
Do. No 1, Good Brands	"	2 13 6	"	2 15 9	"
Scotch Bars	"	7 10 0	"	8 0 0	3
Swedish Bars, in London	"	11 10 0	"	12 0 0	2½
COPPER:					
Sheet and Sheathing	per lb.	0 0 12	"	0 0 0	3
Tough Cake and Tile	pr.ton	107 10 0	"	0 0 0	
Best Selected	"	110 10 0	"	0 0 0	"
Australian	"	112 0 0	"	0 0 0	"
South American	"	100 0 0	"	0 0 0	"
Yellow Metal Sheathing	per lb.	0 0 10	"	0 0 0	"
STEEL:					
Swedish Keg	pr.ton	19 0 0	"	19 10 0	2½
" Faggot	"	21 0 0	"	0 0 0	"
TIN:					
English, Block	p.cwt.	6 12 0	"	0 0 0	2½
" Bar	"	6 13 0	"	0 0 0	"
Foreign, Banca	"	6 14 0	"	6 16 0	nett
" Straits	"	6 9 0	"	6 12 0	"
TINPLATES:					
Charcoal, I.C.	pr.box	1 11 6	"	1 13 0	3
Coke, I C	"	1 5 6	"	1 6 0	"
LEAD:					
Pig, English	pr.ton	22 0 0	"	22 10 0	2½
" Spanish	"	21 5 0	"	22 5 0	"
Sheet	"	22 10 0	"	24 0 0	"
SPELTER:					
On the spot	"	21 12 6	"	21 15 0	nett
For arrival	"	0 0 0	"	0 0 0	"
ZINC:					
English Sheet	"	27 0 0	"	0 0 0	1½
QUICKSILVER	pr.btl.	7 0 0	"	0 0 0	1½

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

LIST OF MISCELLANEOUS TENDERS IN VITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

CHURCH, *Ripley, Derby.*—For the erection of a new tower, chancel, and vestry; extension of nave, and sundry alterations and additions to the parish church of Ripley. Plans, office of Mr. R. Barber, architect, Eastwood, Nottingham. Tenders to Dec. 17.

SMALL SCREW STEAMER, *France.*—For river navigation, capable of carrying 15 to 20 tons of iron in bars 20 feet long. Address with particulars to Messrs. Adrien, Langlois and Co., Maitres de Forges à Basse Indrid. près Nantes, Loire Infer., France.

PIG IRON, *India House.*—Conditions at the Secretariat office, where proposals before eleven, Nov. 29.

COPPER, *Navy.*—For supplying Her Majesty's Dockyard at Châtham with copper in ingots of 112 lbs. each, 60 tons; copper in ingots of 140 lbs. each, 70 tons; copper in ingots about 14 lbs. each refined without lead, 30 tons; tough cake copper, 40 tons. Conditions of contract and form of tender at the office of the Storekeeper-General, Somerset-place, where tenders to 2 o'clock, Nov. 29, addressed to the Secretary of the Admiralty, and be accompanied by a letter signed by two sureties and the person tendering for £5,000.

COALS, *Navy.*—For supplying and delivering into Her Majesty's Victualling stores at Plymouth 1,000 tons of Bryndorway, Graigola, Resolvue, Llangenneck, Newport, Merthyr, or Aberaman Merthyr coals. To be delivered in 24 weeks in four instalments at intervals of six weeks. Form of tenders, Victualling-yard, Plymouth, the officer conducting the packet-service, Liverpool, or collector of customs, Bristol. Attention is called to the modification of conditions. Tenders, to 1.30, Dec. 1, to Secretary of Admiralty, Somerset-house.

SUPPLY OF MATERIALS, *Greenwich Hospital.*—For one year, and three month's notice to continue or discontinue. To include bricklayers and plasters, masons, slaters, plumbers (lead, pipe, and tin), brass-founders (cocks, &c.), carpenters (timbers, deals, &c.), smiths (cast and wrought-iron, &c.), ironmongers, locksmiths, bell-hangers, and tinmans, gasfitters, painters, &c. Printed forms, Inspector of works, at the Hospital. Tenders, noon, Dec. 8, to Secretary of the Hospital.

TENDERS FOR OLD RAILS.—The Directors of the North British Railway are prepared to receive tenders for the sale of 800 tons of old rails, to be delivered either at Leith station or St. Margaret's station, near Edinburgh. Particulars, locomotive superintendent, St. Margaret's. Tenders at the secretary's office, Canal-street, Edinburgh, noon, Nov. 30.

PONTOON SHED, *Sandhurst, Berks.*—For a pontoon shed at the Royal Military College, Sandhurst. Parties desiring to tender for the erection of these works must leave their names at the Royal Engineer Office, Aldershot, on 29th inst., and pay the sum of half-a-guinea for the bills of quantities.

BRIDGE, *Pilkington and Radcliffe.*—For widening Radcliffe-bridge. Plans, &c., office of Wm. Radford, bridge-master, 41 John Dalton-street, Manchester. Tenders to the Radcliffe-bridge Committee, sealed and endorsed Radcliffe-bridge Committee.

BRIDGE, *Pembridge, Herefordshire.*—For building a new stone bridge over the river Arrow at Pembridge. Plans, &c., office of Mr. John Cleave, clerk of the peace, Shirehall, Hereford, and office of Mr. John Gray, county surveyor, King's-acre, near Hereford. Tenders, Dec. 20.

SCHOOL, *Wootton Basset, Wiltshire.*—For the erection of new school-buildings. Plans, &c., office of Edward W. Mantell, architect, Swindon. Tenders, Dec. 10.

POLICE STATION, *Over Darwen.*—Plans, Mr. Inspector M'Donald, police station, Over Darwen. Tenders to Mr. Superintendent Higgs, King-street, Blackburn, to Dec. 20.

ARCADE, SHOPS, BILLIARD-ROOM, &c., *Tynemouth.*—For the whole or any portion of the work. Plans and bills of quantities, office of Mr. Archibald M. Dunn, architect to the Directors of the Tynemouth Assembly and Promenade Company (Limited), Market-street, Tynemouth, where tenders, noon Nov. 29.

PRINTING OFFICES, *Nottingham.*—For the erection of extensive printing offices with warehouses and sale shops adjoining. Plans, &c., office of Mr. W. Booker, architect, High Pavement, Nottingham. No date given.

FARMHOUSE AND PREMISES, *Shobdon-court, near Leominster, Herefordshire.*—For the erection of a farmhouse and premises, comprising stable, loft, granaries, sheds, hospital yards, &c. Plan, office of E. Lloyd, Esq., solicitor, Leominster. Tenders to Dec. 8.

HOUSE, *Calverley.*—For the masons,' plumbers,' plasterers,' slaters, and painters' work in villa residence and outbuilding. Drawings, office of Mr. Geo. Smith, surveyor, 171 Park-lane, Leeds. Tenders, Dec. 1.

ROOFING, *Wolverhampton.*—For the roofing in of the whole of the central area of the Market Hall, and for sundry fittings and stalls therein. Plans and specifications. Mr. Geo. Bidlake, architect, and tenders to Markets Committee of Town Council, Dec. 3.

LANTHORN OUTFALL TUNNEL SEWER, *London.*—For the construction of a main brick sewer seven miles 2,240 feet in length (5,000 feet of this length being in tunnel), and for the execution of other work in connection therewith; such sewer to extend from a point in Erith marshes to Woolwich, and through and under Woolwich to Norman's-road, Greenwich. Plans, section, and form of tender for £3 from Mr. J. W. Bazalgette, engineer of the board, 1 Greek-street, Soho, where tenders before 4 p.m. Jan. 5.

LEVELLING TEN STREETS, *Wolverhampton.*—For levelling, paving, curving, channeling, and draining, to be executed according to plans, sections, and specifications to be seen at the Borough Surveyor's office. Tenders sealed and addressed to the Chairman of the Streets Committee, 3rd Dec.

STREETS, CULVERTS, &c., *Larches Estate, Wolverhampton.*—Plans, &c., office of Messrs. Walker, Lloyd, and Walters, surveyors and auctioneers, Exchange-street. Tenders, 29th November, to the Chairman of the Second Wolverhampton Freeholders Building Society, 1 King-street, Wolverhampton.

MAKING NEW ROAD, *Handsworth, near Birmingham.*—Plan, section, and specification, offices of E. & C. Robins, surveyors and auctioneers, New-street, Birmingham.

PAVING, *Oxford.*—For providing and laying York curb and paving for footways, and granite paving for roadways, and other works, for the Oxford Paving Commissioners for the term of one year from January 1st, 1860. Specifications and particulars, Commissioner's office, Town-hall-yard, daily from 9 till 4, or by letter addressed to Mr. Galpin, surveyor.

PLANS FOR BATHS, *Lytham.*—Two premiums, namely, twenty guineas and ten guineas respectively for the first and second best designs of such structures as shall not involve an expenditure of more than £5,000. Plans, &c., Estate Office, Lytham, Jan. 1st.

ACCOUNTANT TO ENGINEERING DEPARTMENT, *Madras Railway Company.*—Salary according to qualification, but not to exceed £500 a-year. Engagement four years, and free passage out. Applications, with testimonials and particulars of age, and previous employment, at the offices, 33 New-Broad-street, London, until the 28th instant.

TO ENGINEERS.—An agent for England to manufacture and supply railway companies with Thompson's Patent Gas Apparatus for lighting trains or carriages with gas. System, high pressure, as in North America. Messrs. Prince and Co., Patent office, 4 Trafalgar-square, Charing-cross.

MECHANICAL DRAUGHTMEN.—A first-class man who has been employed in some well-known marine engine factory, and can produce first-class testimonials. Address, Martin Samuelson and Co., Hull. A marine engine draughtsman for an old established concern in the country to take the lead in the office. A thoroughly competent person will be liberally dealt with. Address, Mr. Matthew Soul, 3 Leadenhall-street, London, E.C.

ENGINEERS' FOREMAN OR MANAGER in the absence of the Principal in a small Engineer's factory in the South of England. To be acquainted with every description of steam and general machinery, and capable of setting out and making plain drawings. Full particulars, with salary, to S. M. F., Southampton.

WORKING FOREMAN.—Capable of taking the management of workmen and apprentices in an engineer's and brass foundry business. A thorough machine draughtsman and pattern-maker, able to work at vice or lathe, and to live on the premises. One accustomed to steam-ship, crane, and pump-work, preferred. Address, S. F., office of this paper. Also two or three first-class mechanics. Apply as above.

BESSEMER STEEL.—The Tenth Part of Bessemer's Patent for the Manufacture of Malleable Iron and Steel in Belgium to be sold. Apply to Mr. W. B. C., the Proprietor, by letter post paid, Poste Restante, Brussels, Belgium. See the *Engineer* of the 24th of June last. (363)

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Complete lists of sizes and prices may be had on application.
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57 ST. PAUL'S CHURCHYARD, LONDON;
28 Lord-street, Liverpool; 16 Market-place, Manchester and Wolverhampton. (4)

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MOST VALUABLE ASSISTANCE will be rendered to persons in the above position; or to such as may be desirous of arranging privately with Creditors. There are thousands of persons who have struggled long against the force of misfortune, but few are aware that by a recent Act all small traders owing debts not exceeding £300, can be entirely raised from their difficulties, in all cases without imprisonment; and, if necessary, cash advanced for the above purpose.
Country Insolvent cases attended to immediately. No charge for consultation. The strictest secresy may be relied on. Address, post paid, to Mr. E. WHITE, 6 Essex-street, Strand. (369)

BALLOONS or Boats Driven by Steam.—The common opinion that Balloons will never be practicable for general travelling is erroneous—the action of Parker's Small Steam Boats shows that they may be propelled at great speed; the Boats are driven by Steam Rockets, which act upon the air. Fuel, a few drops of spirits; Boats complete, 5 in. for a basin, 3s. post free; 13 in. for ponds, 5s. 6d. rail free.
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These Small Boats go twice the speed of any others with half the fuel; a Steel Rocket of 150 lbs., steam pressure, 1,000 lbs. (1-20th of gunpowder) would drive a Cylindrical Balloon—with pointed ends, capable of carrying one passenger—ten miles per hour. (350)

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USED IN THE ROYAL LAUNDRY,
AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.
WHEN YOU ASK FOR
GLENFIELD PATENT STARCH,
SEE THAT YOU GET IT,
as inferior kinds are often substituted.
Sold by all Chandlers, Grocers, &c., &c. (75

THE IMPERIAL IRON TUBE COMPANY (Successors to GEORGE B. LLOYD and Co.), Gas-street and Berkley-street, Birmingham,
Manufacturers of Wrought Iron Tubes and Fittings, for Gas, Steam, and Water. Patent Glass-Enamelled and Galvanised Tubes, and Lap-welded Iron Boiler Tubes. 347)

ARTESIAN WELLS, BORING TOOLS, PUMPS, &c. Engineers, Architects, Surveyors, Builders or others requiring a good supply of Water may have any quantity procured by W. SPELLER, 14 York-street Blackfriars'-road, London, where may be had any quantity of Tools for Sinking or Boring, from 2 to 20 inches diameter, and from 100 to 2,000 feet depth; also Men and Tools to bore for Railroads, Minerals, &c., in any part of the world. Boring Tools and suitable Pipes for exportation, with full instructions for their use.
Builders, Contractors, Brickmakers, Barge and Snip Builders, and others, can be supplied with Wrought or Cast Iron Pumps, Double or Single, for excavation of Deep Wells, from 3 to 14 inches in the bore, and from 6 to 130 feet in length, to work by hand or Steam Power.
Hot-Water Apparatus for Conservatories, &c., on the most economical and improved principles.
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IRON SHIPS may be rendered FIREPROOF if internally fitted with Fibrous Slab in lieu of Deal.
Extract from a letter of the Captain of the Royal Bride Steamer, trading between Bristol and Melbourne:—"25th May, 1859.—From my experience of the last nine months in all climates, I have no hesitation in saying there is no kind of lining I know of equal to your Fibrous Slab for Iron Ships.—Yours, &c. (Signed), ALEX. NEWLAND."
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FUEL AND STEAM ECONOMY.—Apply to Mr. LEE STEVENS, C.E., 1 Fish-street-hill, E.C. 215)

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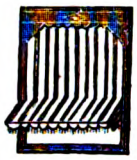
WINDOW BLIND MANUFACTURER,

Wholesale and Retail, and for Exportation,

ON THE MOST REASONABLE TERMS.



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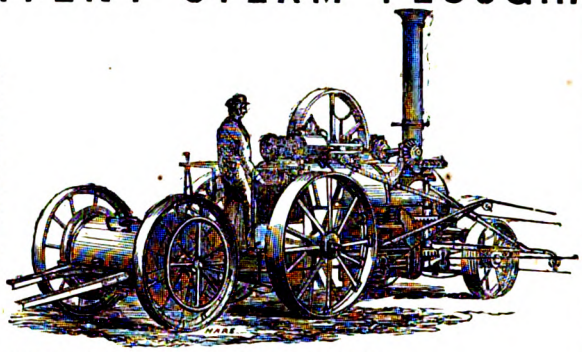
FOWLER'S PATENT STEAM PLOUGH.

ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching-Plough, and Scarifier.



The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

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Families, by using this delicious VINEGAR, insure purity and effect a saving of 50 per cent. See "Report of Dr. Letheby, City Officer of Health, Dr. Hassall, of the 'Lancet' Commission, and others." Sold by the Trade, in Bottles, labelled and capsuled. Wholesale—63 King William-street, London-bridge, E.C. Six Quart Samples sent free to any Railway for 3s. 6d. (216)

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TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine

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and that Springs thus marked are warranted.

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DRAUGHTS of COLD AIR and DUST round Room, Office, or outside Doors and Windows EFFECTUALLY PREVENTED by GREENWOOD'S PATENT INDIA-RUBBER STOPS, the most simple and effectual method of making air-tight joints to joiners' or cabinet work, old or new. These Stops can be had any length or pattern. Self-acting Spring Stops, for the bottoms of doors.

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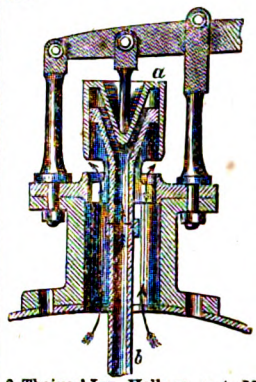

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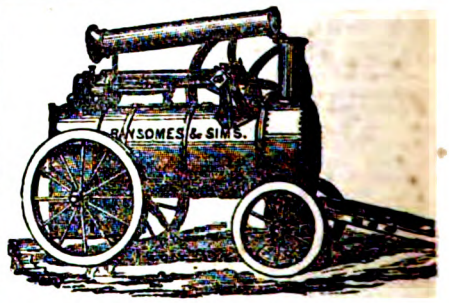

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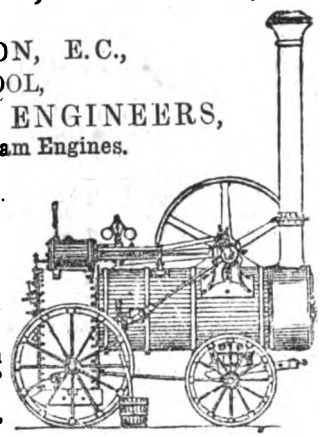

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AND

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METROPOLITAN BOARD of WORKS.—MAIN DRAINAGE of METROPOLIS.—SOUTHERN OUTFALL TUNNEL SEWER. — To BUILDERS and CONTRACTORS experienced in Tunnel Works.—The Metropolitan Board of Works hereby give notice, that they will MEET in the Council Chamber, Guildhall, in the City of London, on Friday, the 6th day of January, 1860, at Twelve o'clock at Noon precisely, and will then be prepared to open TENDERS by parties who may be willing to CONTRACT for the CONSTRUCTION of a MAIN BRICK SEWER, 7 miles 2,240 feet in length, or thereabouts (5,000 feet of this length being in tunnel), and for the execution of other works in connection therewith; such sewer to extend from a point in Erith Marshes, opposite Dagenham Breach, in the county of Kent, to Woolwich, and through and under Woolwich to Norman's-road, otherwise North Pole-lane, Greenwich, in the same county.

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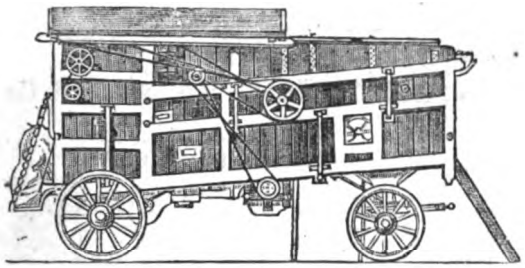

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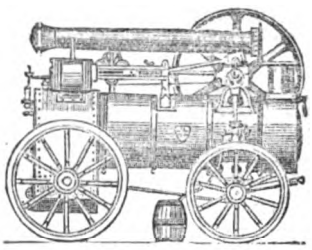

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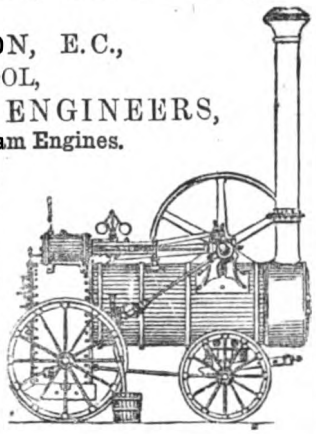

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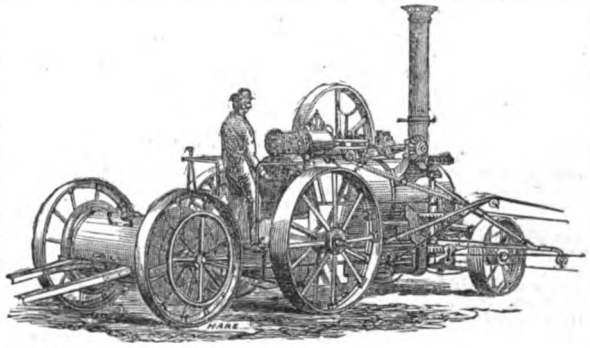

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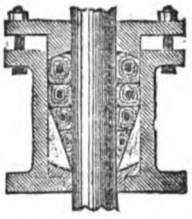

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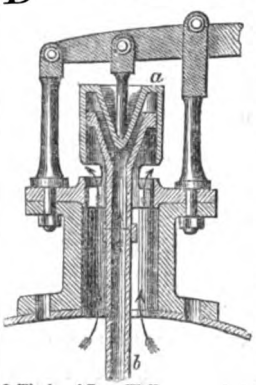

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TO INVENTORS AND PATENTEES.

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Civil Engineers

AND PATENT AGENTS,

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ROBERTSON, BROOMAN, & Co.,

"MECHANICS' MAGAZINE" & PATENT OFFICE,

166 FLEET STREET, LONDON, E.C. (16)

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PRICES CURRENT OF METALS.

London, Dec. 2nd, 1859.

		£ s. d.		£ s. d.	Dis.
IRON:					p.ct.
Rails in Wales and North of England	pr.ton	6 0 0	to	6 5 0	nett
Welsh Bars, in Wales	„	5 17 6	„	6 0 0	3
Staf. Bars, at the Works	„	7 0 0	„	7 10 0	2½
„ Hoops	„	8 0 0	„	8 10 0	„
„ Sheets, Singles	„	8 10 0	„	9 0 0	„
„ Nail Rods	„	7 0 0	„	7 10 0	„
„ Boiler Plates	„	8 10 0	„	9 0 0	„
Scotch Pig, M.-Nos. Warrants, at Glasgow	„	2 13 3	„	2 13 6	nett
Do. No 1, Good Brands	„	2 13 9	„	2 14 0	„
Scotch Bars	„	7 10 0	„	8 0 0	3
Swedish Bars, in London	„	11 15 0	„	12 0 0	2½
COPPER:					
Sheet and Sheathing	per lb.	0 0 12½	„	0 0 0	3
Tough Cake and Tile	pr. ton	112 0 0	„	0 0 0	
Best Selected	„	115 0 0	„	0 0 0	„
Australian	„	114 0 0	„	0 0 0	„
South American	„	100 0 0	„	102 0 0	„
Yellow Metal Sheathing	per lb.	0 0 10½	„	0 0 0	„
STEEL:					
Swedish Keg	pr. ton	19 0 0	„	19 10 0	2½
„ Faggot	„	21 0 0	„	21 5 0	„
TIN:					
English, Block	p. cwt.	6 15 0	„	0 0 0	2½
„ Bar	„	6 16 0	„	0 0 0	„
Foreign, Banca	„	6 14 0	„	6 16 0	nett
„ Straits	„	6 9 0	„	6 12 0	„
TINPLATES:					
Charcoal, I.C.	pr.box	1 11 6	„	1 13 0	3
Coke, I.C.	„	1 5 6	„	1 6 6	„
LEAD:					
Pig, English	pr. ton	22 10 0	„	23 0 0	2½
„ Spanish	„	21 15 0	„	22 15 0	„
Sheet	„	22 10 0	„	23 10 0	„
SPELTER:					
On the spot	„	21 10 0	„	0 0 0	nett
For arrival	„	21 10 0	„	21 12 6	„
ZINC:					
English Sheet	„	27 0 0	„	0 0 0	1½
QUICKSILVER	pr.btl.	7 0 0	„	0 0 0	1½

REMARKS.—There is a greater disposition to business, but the amount of transactions continues limited. The Copper houses have advanced: English Copper, ½d. per lb. on manufactured, and £4 18s. per ton on cake and tile; and the Tin houses have made an advance of £3 per ton on English Tin. Lead is about 10s. per ton higher.

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

STEAM ENGINE, *Birmingham.*—For a thirty-horse black condensing steam engine of guaranteed good construction, to be erected and finished within three months from the present date. Address, 309 *Daily Post* Office, Birmingham.

RAILWAY, *Scotland.*—For the works on the remaining portion of the main line of the Port Patrick Railway from near Stranrear to Portpatrick, together with the Portpatrick Harbour Branch. The rails will be supplied by the company. The assistant engineer will attend at the King's Arms, Stranrear, at 10 a.m., Dec. 8, to accompany intending offerers over the works, and he will remain at Stranrear on the 9th further to exhibit the drawings and specifications, to be seen at the Messrs. B. and E. Blyth, 135 George-street, Edinburgh, and duplicate schedules obtained for 40s. Forms of tender from the engineers, or the secretary (Mr. A. Ingram, Stranrear), to whom tenders, Dec. 19.

LIGHTHOUSE WORK, *Ireland.*—For additional rooms over the dwelling adjoining the tower of the Tuscar Rock Lighthouse, conformably to the plans, sections, and specifications to be seen from 11 to 3 daily at the Ballast Office, Dublin, or at the office of Capt. E. Roach, Wexford, where also printed forms of tender. Tenders to Mr. W. Lees, secretary to Port of Dublin Corporation, Dec. 15.

LIGHTHOUSE LANTERN, *Trinity Board.*—A lantern for the Smalls Lighthouse. Plans, specifications, forms, conditions, Trinity House, where tenders by 10 a.m., Dec. 6.

LYCHGATE, BOUNDARY WALLS, &c., *Woodstock.*—1st, for erecting a lych gate and the boundary walls of the ground; 2nd., furnishing and erecting iron palisades and sliding gates; 3rd., laying out the ground, making and completing the roads. Plans, &c., office of Mr. Hawkins, Woodstock, Oxon. Tenders to Dec. 5.

BRIDGE, *Llandaff.*—For the erection of a small bridge and boundary walls to enclose some new ground adjoining the Cathedral yard, also for planting, draining, and forming roads therein. Drawings, office of Messrs. Prichard and Sendon, diocesan architects, Llandaff. Tenders, Dec. 16.

SEWERS, *Kingston-upon-Hull.*—For the cleansing and repair of the public sewers within the above borough for a period of one or three years from January 7th, 1860. Specifications of Mr. K. A. Marillier, surveyor, 73 Lowgate, Hull, until Nov. 30. Tenders to Dec. 9.

ROAD, *Penkhull and Hartshill.*—For making a new road with the fences thereto leading from Penkhull to Hartshill through the Mount Estate. Plans, &c., office of Mr. Lynham, surveyor, &c., Stoke-upon-Trent. Tenders, Messrs. Bishop and Blackiston, solicitors, Shelton, Dec. 12.

CAST-STEEL FILES, AND RASPS, AND STEEL, *India Office.*—For the supply of cast-steel files and rasps, and steel. Conditions of the contracts (two in number) at the Secretariat Office. Tenders before 11 o'clock, Dec. 6.

RAILWAY STORES, *Lancashire and Yorkshire.*—For the supply of the company's requirements in the ensuing half-year, to include coal (engine and furnace), coke and coal (smithy), copper and block tin, files and steel, iron (bar and plate), nails, and tubes iron for locomotive engines. Further particulars and forms, Mr. R. J. Budge, the company's storekeeper, at the offices, Miles Platting, on and after Dec. 14. Tenders with the Secretary, Manchester, at 10 a.m., Dec. 23. Separate forms for each contract.

COALS, *Navy.*—For supplying and delivering into Her Majesty's Victualling Stores at Deptford 700 tons of South Wales coals, to be delivered one-half January 31, and the remainder by the 29th Feb., 1860. Forms of tender at the office of the Comptroller for Victualling, Somerset House; of the officer conducting the Packet Service, Liverpool; or of the Collector of Customs, Bristol. No tender will be received after half-past one, Dec. 8; to be addressed to Secretary of Admiralty. Personal attendance unnecessary.

COALS, *Navy.*—300 tons of South Wales for Gosport. Forms Somerset House, Gosport, Liverpool, and Bristol. The coals to be delivered by the 31st of March, 1860. Attention, as in the foregoing case, called to the recent modification of the conditions. Tenders by half-past one, Dec. 8.

ROAD MATERIALS, *London.*—For the supply of the materials for the roads north of the Thames. Particulars at the office of the commissioners, 22 Whitehall-place, to which place tenders, Dec. 20.

VALUATION, *Altrincham.*—For new valuation and book of reference of all property in the township of Altrincham for the purposes of the Poor-rate assessment; also a plan of the township on an enlarged scale of double the size of the recent survey made for the Board of Health. Tenders, Dec. 8th, endorsed Altrincham Township Surveyor, 14 High-street.

IRONWORKS MANAGER.—One thoroughly experienced and conversant with the manufacture of iron in all its departments, including heavy forging and uses; he must be accustomed to the keeping of cast, yield, and stock accounts. H., 119 *Guardian* office, Manchester.

GAS MANAGER.—To undertake the management of the Eastbourne Gasworks, supplying all labour necessary for the manufacture and distribution of gas, the lighting of the public lamps, the laying-down of new mains, and the laying-on of new services, &c Further particulars, Mr. J. H. Campion Coles, Secretary, Eastbourne; to whom applications, with terms and testimonials, Dec. 10.

BRASS TUBE MILL MANAGER.—To superintend a brass tube mill. Must be experienced in making both solid, drawn, and braized brass and copper tubes, and thoroughly understand the nature of metals. Address, H. 3 *Journal* office, Birmingham.

TWO HUNDRED TO THREE HUNDRED NAVVIES on the South Durham and Lancashire Union Railway. Accommodation on the works, liberal wages. Apply at the contractor's offices, Kirkby Stephen, Westmoreland.

TO ADVERTISERS.

All Advertisements occupying less than half-a-column are charged at the rate of 5d. per line for any number of insertions less than 13; for 13 insertions, 4d. per line; and for 52 insertions, 3d. per line.

Each line consists of 10 words, the first line counting as two. Wood-cuts are charged at the same rate as type for the space occupied.

Special Arrangements for larger or Serial Advertisements To ensure insertion, Advertisements must reach the Office by 5 o'clock on Thursday evening each week. None can be received after that time for the ensuing number.

BOURDON'S PRESSURE and VACUUM GAUGES.—These instruments may be obtained from JOHN DEWRANCE & Co. (the sole proprietors in Great Britain and the Colonies), 5 Barge-yard, Bucklersbury, London, and from their agents, as follows:—
Manchester—ALLEN, HARRISON, & Co., Cambride-street; ROUTLEDGE, New Bridge-street, Salford.
Glasgow—ALEXANDER MITCHELL, 350 Parliamentary-road.
Belfast—GEO. H. STRYPE, York-street Foundry.
Birmingham—ADAM DIXON, 48 Newhall-hill.
Newport, Mon.—H. POOLEY & SON.
Newcastle-on-Tyne—GEORGE HARLE, Dean-street. (395)

THE IMPERIAL IRON TUBE COMPANY (Successors to GEORGE B. LLOYD and Co.), Gas-street and Berkley-street, Birmingham, Manufacturers of Wrought Iron Tubes and Fittings, for Gas, Steam, and Water. Patent Glass-Enamelled and Galvanised Tubes, and Lap-welded Iron Boiler Tubes. 347)

FUEL AND STEAM ECONOMY.—Apply to Mr. LEE STEVENS, C.E., 1 Fish-street-hill, E.C. 243)

EMIGRATION TO NEW YORK, CANADA, AUSTRALIA, NEW ZEALAND, EAST INDIES, CAPE OF GOOD HOPE, &c. All Classes of Passengers booked throughout in the Finest Steam and Sailing Packets. Full Particulars in our circulars for 1859, may be had gratis on application to F. S. GRAY and Co., 54 King William Street, City, and 6 Tower Hill, London; and at 35 Bath Street, Liverpool. (187)

TO WIRE ROPE MAKERS.—ARCHIBALD SMITH is now prepared to GRANT LICENCES for the use of his PATENT ROPE MACHINERY, guaranteed to work at six times the speed of any other, and to save upwards of fifty per cent. in the cost of making. It is used by the most eminent makers, and was also in the manufacture of the Atlantic Cable.—Apply to 69 Princes-street, Leicester-square, W. 198)

TO INSOLVENT DEBTORS, BANKRUPTS, &c.

MOST VALUABLE ASSISTANCE will be rendered to persons in the above position; or to such as may be desirous of arranging privately with Creditors. There are thousands of persons who have struggled long against the force of misfortune, but few are aware that by a recent Act all small traders owing debts not exceeding £300, can be entirely raised from their difficulties, in all cases without imprisonment; and, if necessary, cash advanced for the above purpose.

Country Insolvent cases attended to immediately. No charge for consultation. The strictest secresy may be relied on. Address, post paid, to Mr. E. WHITE, 6 Essex-street, Strand. (369)

GLENFIELD PATENT STARCH,
USED IN THE ROYAL LAUNDRY,
AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.
WHEN YOU ASK FOR
GLENFIELD PATENT STARCH,
SEE THAT YOU GET IT,
as inferior kinds are often substituted.
Sold by all Chandlers, Grocers, &c.,' &c. (75

ARTESIAN WELLS, BORING TOOLS, PUMPS, &c. Engineers, Architects, Surveyors, Builders or others requiring a good supply of Water may have any quantity procured by W. SPELLER, 14 York-street Blackfriars'-road, London, where may be had any quantity of Tools for Sinking or Boring, from 2 to 20 inches diameter, and from 100 to 2,000 feet depth; also Men and Tools to bore for Railroads, Minerals, &c., in any part of the world. Boring Tools and suitable Pipes for exportation, with full instructions for their use.

Builders, Contractors, Brickmakers, Barge and Ship Builders, and others, can be supplied with Wrought or Cast Iron Pumps, Double or Single, for excavation of Deep Wells, from 3 to 14 inches in the bore, and from 6 to 130 feet in length, to work by hand or Steam Power.

Hot-Water Apparatus for Conservatories, &c., on the most economical and improved principles.

Also Manufactory for Captain John Grant's much improved Cooking Apparatus. (44)

TO SHIPBUILDERS.

IRON SHIPS may be rendered FIRE-PROOF if internally fitted with Fibrous Slab in lieu of Deal.

Extract from a letter of the Captain of the Royal Bride Steamer, trading between Bristol and Melbourne:—"25th May, 1859.—From my experience of the last nine months in all climates, I have no hesitation in saying there is no kind of lining I know of equal to your Fibrous Slab for Iron Ships.—Yours, &c. (Signed), ALEX. NEWLAND."

PATENT WOOD OR FIBROUS SLAB COMPANY,
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Sold by all Cutlers and Ironmongers, and at the Patentee's Wholesale Warehouse, 23, 24, 25 Fleet Street, London. (178)

STOVES.—The only Stoves for which a Prize Medal was awarded at the Paris Exhibition in 1855 were WALKER'S PATENT SELF-FEEDING STOVES.

They are acknowledged, after Twelve Years' Experience, to be the most Economical and Perfect Hot-Air Stoves invented for warming Churches, Gentlemen's Halls, Shops, &c. They will burn for Sixteen Hours with one supply of fuel, requiring no attention. These and WALKER'S IMPROVED MASSEY'S SHIP LOGS are to be had of all respectable Ironmongers, or at the Manufactory, 58 Oxford-street, Birmingham; where Prospectuses and Testimonials may be obtained. (378)

CAUTION.

TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine SMITH'S PATENT DOOR SPRINGS, for Swing Doors, are stamped with Name and Address, thus—SMITH, Patentee, 69 Princes-street, Leicester-square, London; and that Springs thus marked are warranted. SMITH'S PATENT WEATHER-TIGHT CASEMENT FASTENING AND SILL-BARS are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. (143)

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By Royal Letters Patent.

T. SUFFIELD AND CO.

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Both Fixed and Portable, with PATENT VALVES and other Improvements.

These Pumps are free from that liability to choke which is common to other Pumps, and their Working Parts are not susceptible of derangement either from wear or from being long out of use. They pass entirely through them, with ease, any substance that may enter the Suction Pipes. The Novelties in these Pumps are their adaptation to the varied duties of Ships' Pumps, the facilities they afford for Cleansing the Suction Pipes, and for Sounding or Examining the Valves; the readiness with which they may be used for Ventilating the Bilge, or for acting as a Syphon either for Watering the Ship, or for extinguishing Accidental Fires on board: the rapidity with which they can be converted into Fire Pumps, or be applied to the Washing of Decks; and their capability of Pumping from Several Compartments. Also, to their

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Which excelled all others in the recent series of Trials in Her Majesty's Navy at Sheerness. These invaluable instruments have been supplied and sent to almost all parts of the world, and in no case has there been any complaint of their working.

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Suitable for testing the speed of all classes of machinery.

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Made to act when placed either above or below the water level. These Closets are simple, efficient, and mechanically arranged for their various requirements, and are not liable to derangement.

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And all kinds of Steam Fittings of the very best quality. As a large Stock of every variety of this class of goods has been much sought after, we trust the present one (especially considering it can be so readily examined in our new premises) will be fully appreciated and meet with the attention it deserves.

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ASSORTED STORES FOR MARINE PURPOSES.

They keep a Large Stock of Goods, of their own Manufacture and from the Best Makers, constantly on view; so that by a visit to their Works or Depôt, much valuable time may be saved by Managers, Engineers, and other Gentlemen who may require such Stores, together with a further saving in the cost of the Articles.

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LONDON. (15)

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TO ENGINEERS, ARCHITECTS, PATENT AGENTS, &c.

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MALLET'S PATENT BUCKLED PLATES.—MR. ROBERT MALLET, C.E., Inventor and Patentee of these Plates (now being laid for the Floor of the New Bridge, Westminster, and applicable to Bridge, Wharf, and Fire-proof flooring, and to a variety of other important purposes) gives notice that he has withdrawn from this date all Licences whatsoever to manufacture or vend his Patent Plates, and taken the management of the Patent exclusively into his own hands. Applications for the Plates to be made to the Patentee, who has arranged for their prompt supply, at his offices, 11 Bridge-street, Westminster, S.W., and 97 Capel-street, Dublin.
18th May, 1859. (264

BIRMINGHAM WAGGON COMPANY (LIMITED) has RAILWAY WAGGONS for HIRE. Apply to the Secretary, 3 Newhall-street, Birmingham. (276)

GOLD and TEETH.—Messrs. BROWNE and CARTWRIGHT, the old-established Surgeon-Dentists, 22 Fleet-street, continue to Stop DECAYED TEETH with their preparation of gold, and to supply their celebrated Teeth, which still stand unequalled among the numerous attempts to imitate them. They are the most clean, wholesome, and natural of any that can be worn. They never change colour or decay, and are fitted without extracting the stumps, or giving the slightest pain, and restoring in every case perfect mastication and articulation. A single tooth, first quality, one guinea; a set, 15 to 18 guineas; second quality—a single tooth, 10s. 6d.; a set, 10 guineas; best American and other third and fourth-class teeth, 4s. per tooth.—22 Fleet-street, near the Temple. (379)

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WILLIAM DRAY and COMPANY, Agricultural and General Engineers, &c., Adelaide Place, London Bridge, invite attention to their new Central Premises, close to London Bridge, where may be seen their celebrated Champion Reaper, Chaff Engines, Oat Bruisers, Post Mills, Pumps, Weighing Machines, Corn Bins, their Patent Self-Adjusting Scythe, Garden Engines, Handsome Garden Seats, Lawn Mowers (every make), Flower Stands, and Garden Tools of all descriptions.
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TO RAILWAY COMPANIES, ENGINEERS, MILL-OWNERS, &c., &c.

THE PATENT PLUMBAGO CRUCIBLE COMPANY draw the attention of all Owners of Machinery to their fine POWDERED PURE FLOUR PLUMBAGO, which they can confidently recommend for Anti-friction purposes, being an impalpable powder, and warranted perfectly free from grit and any impurity.
For ordinary polishing purposes it will be found superior to any Black Leads offered.
Price £27 10s. per ton, £1 10s. per cwt.; samples of 28 lbs. forwarded on receipt of 8s. Packages free.
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MESSRS. BOOTH & CO., AUCTIONEERS and BUILDERS' SALESMEN, having opened Registers for Public and Private Sales of all kinds of JOB LOTS, Surplus Stock, Stores, Tools, Implements, &c., &c., (either Old or New,) beg to call the attention of all parties to the only medium established of the kind, and to state that they are prepared to receive consignments of any weight, bulk, or value, and of any class of Goods for immediate Sale. Full particulars may be had for two stamps, at the BUILDING TRADES REGISTRY OFFICES, (established 1857,) 13 EASTCHEAP, LONDON, E.C. The Public Sales by Auction are held Weekly, on EVERY TUESDAY, at ONE O'CLOCK, and for the present at the BUILDERS' SALE GROUNDS, (established 1858,) 23 and 24 MARYLEBONE ROAD, REGENT'S PARK, W. Catalogues by Post for One Stamp. Advances on New Goods. All communications are held private and confidential. (204)

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LOCOMOTIVE TYRE-BARS of every description for Engines, Carriages, and Railway Waggon Wheels.
STEEL-IRON for Springs. MERCHANT and other Irons manufactured. WM. F. HOYLE, Proprietor. (278

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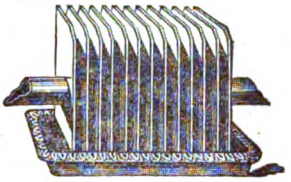

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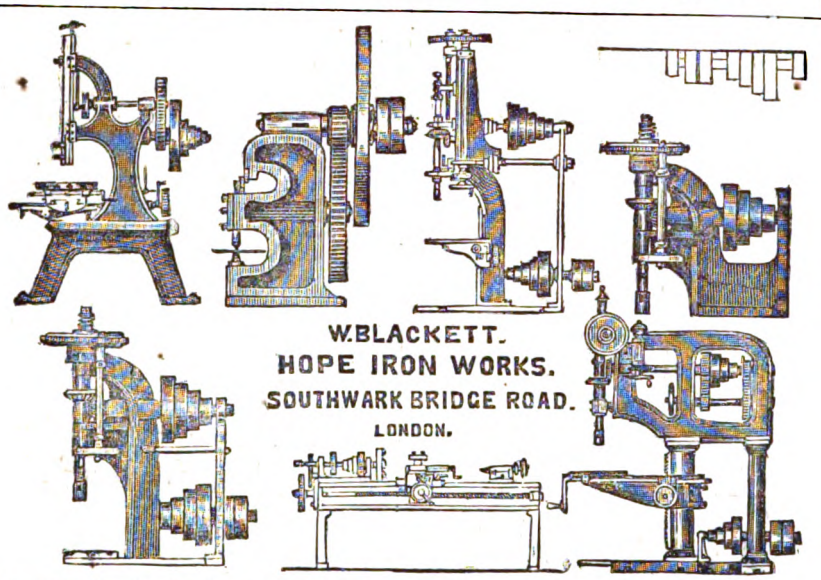

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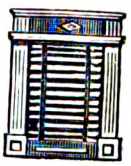

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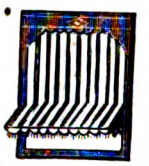

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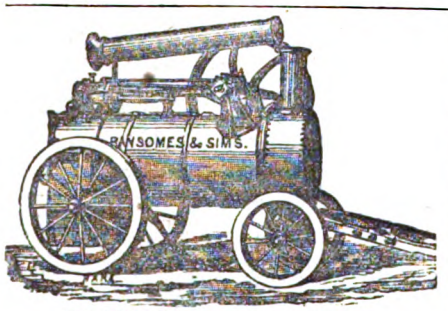

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 50. [NEW SERIES.]

LONDON: FRIDAY EVENING, DECEMBER 9, 1859.

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18th May, 1859. (264

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GOLD and TEETH.—Messrs. BROWNE and CARTWRIGHT, the old-established Surgeon-Dentists, 22 Fleet-street, continue to Stop DECAYED TEETH with their preparation of gold, and to supply their celebrated Teeth, which still stand unequalled among the numerous attempts to imitate them. They are the most clean, wholesome, and natural of any that can be worn. They never change colour or decay, and are fitted without extracting the stumps, or giving the slightest pain, and restoring in every case perfect mastication and articulation. A single tooth, first quality, one guinea; a set, 15 to 18 guineas; second quality—a single tooth, 10s. 6d.; a set, 10 guineas; best American and other third and fourth-class teeth, 4s. per tooth.—22 Fleet-street, near the Temple. (379)

INDIA-RUBBER VALVES FOR STEAM ENGINES, PUMP PACKING, &c.—Explanatory Drawings and Information as to the best modes of fitting and arranging the above, and all other Mechanical Applications of VULCANISED INDIA-RUBBER, are furnished post-free by

CHARLES MACINTOSH & Co., Patentees, Cambridge-st., Manchester, and 3 Cannon-st. West, London.
MANUFACTORY and DEPÔT, Cambridge-st., Manchester.
GENERAL WAREHOUSE, 3 Cannon-street West, London, E.C.—C. M. and Co.'s only Establishments. (139

CAUTION.

TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine

SMITH'S PATENT DOOR SPRINGS,

for Swing Doors, are stamped with Name and Address, thus—

SMITH, PATENTEE, 69 PRINCES STREET, LEICESTER SQUARE, LONDON,

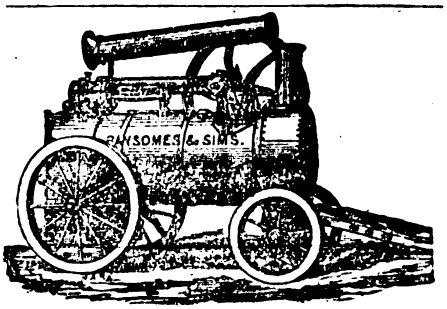
and that Springs thus marked are warranted.

SMITH'S PATENT WEATHER-TIGHT CASEMENT FASTENING AND SILL-BARS

are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. (195

Important to every man who keeps

THORLEY'S FOOD FOR CATTLE,
77, NEWGATE STREET, LONDON
Price 50s. per Cask, containing 448 Feeds
Carriage paid to any Station.
A Pamphlet, Post-free on application. (188)



RANSOMES AND SIMS,
IPSWICH,
AGRICULTURAL & GENERAL ENGINEERS AND IRONFOUNDERS.
LONDON OFFICE: 31 ESSEX STREET, STRAND, W.C. (165)

TO BRASS-FOUNDERS, ENGINEERS, &c.

THE PATENT PLUMBAGO CRUCIBLE COMPANY having completed the enlargement of their premises, beg to call the attention of all users and shippers of Melting Pots to the great superiority of the PATENT CRUCIBLES, which have been used during the last three years by some of the largest melters in England and abroad. In addition to their capabilities of melting an average of from thirty-five to forty pourings, they are unaffected by change of temperature, never crack, but can be used till worn out, requiring only one annealing for several days' work, and become heated much more rapidly than ordinary pots, effecting thereby a saving of more than fifty per cent. in time, labour, fuel, and waste. The Patent Plumbago Crucible Company also manufacture and import clay crucibles, muffles, portable furnaces, sublimate pans and covers, glass-pots, all descriptions of fire-standing goods, and every requisite for the assayer and dentists. For Lists, Testimonials, &c., apply to Battersea Works, London, S.W. 48

J. BLOOMFIELD,
MAKER OF
WORKING SECTIONAL MODELS OF STEAM ENGINES, IN WOOD OR METAL,
10½ ST. JAMES'S PLACE, HAMPSTEAD ROAD.

Mr. BLOOMFIELD, having had many years' experience in making models for the late firm of Watkins and Hill, of Charing-cross, can confidently guarantee accuracy of workmanship at very reasonable charges. (329)

SMALL GAS APPARATUS, WITH FREEDOM FROM NUISANCE.

THE PATENT NATIONAL COAL-GAS APPARATUS,

FOR
Private Residences, Farm Buildings, Churches, Chapels, Railway Stations,
And all isolated places not yet lighted with Gas.

The various parts are of the best materials and workmanship, are not liable to get out of order, and can be worked with a small degree of attention by a farm-servant or labourer without materially interfering with his other duties.

Prospectuses with Testimonials, &c., may be had on application to the Proprietors and Manufacturers,

J. T. B. PORTER and CO., Lincoln. (346)

INVENTORS, ENGINEERS, AND OTHERS.

AN Engineer of much Experience can give Assistance in Practically Arranging Inventions, contriving Machinery, Preparing Drawings Tracings, &c. Address, M. E., 9 Parliament-street, Westminster. (304)

CRAWHALL AND CAMPBELL,

MACHINE AND TOOL MAKERS,

AND MILLWRIGHTS,

ELLIOT WORKS, FINNIESTON,

GLASGOW.

Manufacturers of Engineers' Tools of every description, Screwing Apparatus of standard gauge, Boring Grabs, &c. (303)

ENGINEERS' TOOLS FOR SALE.—A Superior SELF-ACTING SLIDE and SCREW-CUTTING LATHE, 7 in. centre and 7 ft. bed. A Ditto, 7 in. centre and 9 ft. bed. A PUNCHING and SHEARING MACHINE, for ⅝ in. plates. Two Ditto for ½ in. plates, and Two Ditto for ⅜ in. plates. VERTICAL DRILLING MACHINE; PILLAR and BENCH DRILLS; HALEY'S and other LIFTING JACKS; RACHET BRACES, &c.

Apply to PAGE and CAMERON, 64 Old Broad-st., E.C., London. (285

RANSOME'S PATENTED PROCESS FOR PRESERVING STONE, CEMENT, STUCCO, &c.—By this process the softest and most friable Stone, Cement, or Stucco, can be rendered Impervious and Imperishable, DECAY AT ONCE ARRESTED AND PREVENTED.

For Particulars, Specimens, Illustrations, and Agencies, apply to Mr. Frederick Ransome, Whitehall Wharf, Cannon-row, Westminster; or Patent Stone Works, Ipswich. A Liberal Discount allowed to the Trade or to Shippers. (170)

EDWIN JEWITT, ENGRAVER ON WOOD AND DRAFTSMAN, 1 Pickett-place, Strand, near Temple-bar. Engineering, Scientific, and Mechanical Designs accurately engraved. Manufacturers and Tradesmen's Catalogues Illustrated. W.C. (84)

YORKSHIRE TYRE & AXLE WORKS, ROTHERHAM.

LOCOMOTIVE TYRE-BARS of every description for Engines, Carriages, and Railway Waggon Wheels.

STEEL-IRON for Springs. MERCHANT and other Irons manufactured. WM. F. HOYLE, Proprietor. (278

ESTABLISHED 1700.

WINDOW BLINDS.—GEO. F. JANES, and CO., Wholesale, Retail, and Export Window Blind Manufacturers, 29 Finsbury Place, and 9, 10, and 11 Cross-street, Finsbury. Estimates given and executed with dispatch. Experienced Workmen sent to any part of the kingdom. (381)

WATER GAUGES—WATER GAUGES.—Sir,—We find your German Gauge Tube superior to any other, and strongly recommend it. We were compelled to abandon the use of our water gauge until applying your glass tube.

WILCOX and Co., Millwall Pottery Company.

These Tubes are superior to all others; being a clear white, no mistake can arise in working. Guaranteed to stand a pressure of 500 lb.

Extensively used on all the principal lines.

To be had only of E. MOORE, 55 Upper Marylebone-street, W.; and 72 Great Titchfield-street, W.

*** Price List of Gauge Fittings, &c., on application. (98)

ISCA FOUNDRY COMPANY, OLD BARRACKS, NEWPORT, MON.
ENGINEERS, AND RAILWAY WAGGON BUILDERS.
Manufacturers of Switches, Points, and Crossings, Chairs, Spikes, Bolts, and General Railway Fittings. (279)

ESTABLISHED 1700.

WINDOW BLINDS.—GEO. F. JANES and CO., Wholesale, Retail, and Export Window Blind Manufacturers, 29 Finsbury-place, and 9, 10, and 11 Cross-street, Finsbury. Estimates given and executed with despatch. Experienced Workmen sent to any part of the kingdom. (355)

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CLAYTON, SHUTTLEWORTH, AND CO.,

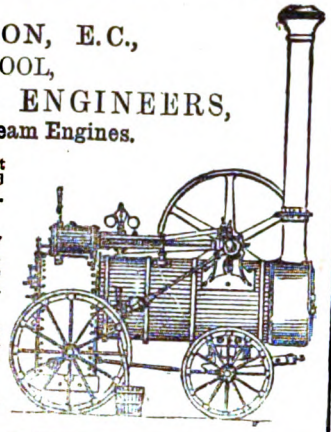
OF LINCOLN,

78 LOMBARD STREET, LONDON, E.C.,

AND 36 DALE STREET, LIVERPOOL,

AGRICULTURAL AND GENERAL ENGINEERS,

And Manufacturers of Portable and Fixed Steam Engines.



Combined Threshing Machines, which dress the corn ready for market at one operation. Grinding Mills, Saw Benches, Pumps for Irrigation and Mining purposes, with all necessary gearing for being driven by steam power. Full particulars and estimates given on application to the above address.

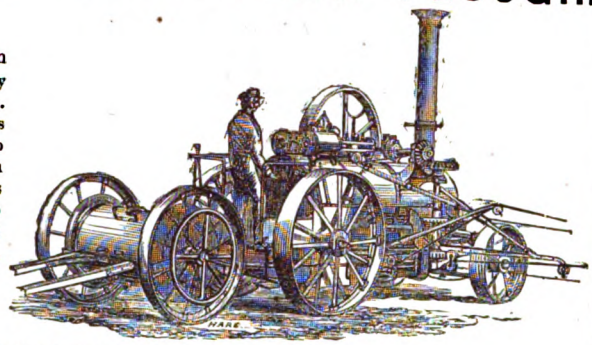
C. S. and Co.'s PORTABLE STEAM ENGINES are adapted for every purpose to which steam-power can be applied. When intended for winding, they are fitted with reversible link motion and winding gear. They are easy of removal, as may be seen by the engraving, and can be set to work immediately on arrival.

C. S. and Co. are now doing an extensive foreign and colonial business, and are prepared to send off engines and machinery of the before-mentioned kinds in a few days from the date of order. They would also call attention to the important *reduction in prices* made for the new year.

For Exportation.---The above can be obtained through British Merchants, Shippers, and Colonial Agents. (23)

FOWLER'S PATENT STEAM PLOUGH.

ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching-Plough, and Scarifier.



The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

For further particulars, Illustrated Catalogues, and Prices, apply to

JOHN FOWLER, JUN., 28 CORNHILL, LONDON, E.C.

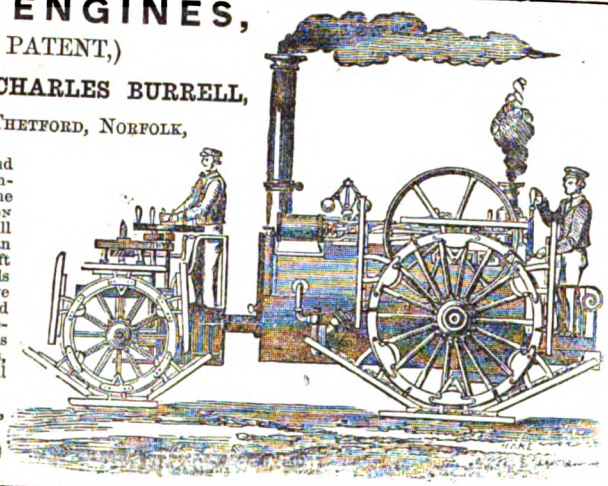
(388)

TRACTION ENGINES,

(BOYDELL'S PATENT,)

MANUFACTURED BY CHARLES BURRELL,

ST. NICHOLAS WORKS, THETFORD, NORFOLK,



And ordered for India, Australia, and South America, may now be seen, complete and in course of construction at the above works. BOYDELL'S TRACTION ENGINES AND ENDLESS RAILWAY will draw heavier loads over good roads than any other traction engine, and on soft and bad roads will draw heavy loads where no other traction engine can move itself. All objection to the wear and tear of these Engines is entirely removed by the use of Charles Burrell's improved patent Wrought Iron Wheels, fitted with Rails and Tyre, as well as all the wearing parts, of Steel.

47 *Apply also to Mr. Hemming, Mark Lane, E.C.*

(40.)

VENETIAN HOUSE, ESTABLISHED 1826.

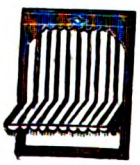
JOSEPH AGACE,

33 UNION-STREET, BOROUGH, S.E.,

WINDOW BLIND MANUFACTURER,

Wholesale and Retail, and for Exportation,

ON THE MOST REASONABLE TERMS.



Engravings, with Price Lists, forwarded on application, post-free. (393)

THE

SILVERTOWN INDIA-RUBBER WORKS

OPPOSITE

H. M. DOCKYARD, WOOLWICH.

INDIA-RUBBER MANUFACTURES

WITH ALL

RECENT IMPROVEMENTS.

Warehouses, 3 and 4 Bishopsgate Within, E.C. (145)

TO MECHANICS.

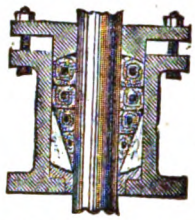
WHO'S YOUR TAILOR?

Try MORDAUNT'S for GOOD and CHEAP CLOTHING,

13, CANNON-ST., LONDON BRIDGE.

(342)

PATENT STEAM PACKING, &c., &c.—TUCK'S PATENT ELASTIC PACKING AND PATENT METALLIC LININGS for STEAM ENGINES, PUMPS, &c.

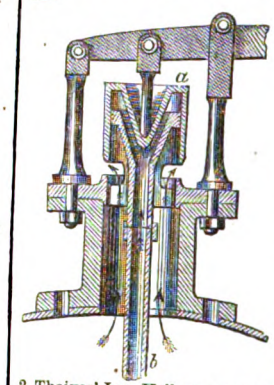


ADVANTAGES.—A more perfect vacuum is obtained, Friction reduced, great saving in oil and tallow, and the Packing is gradually and completely worn away without becoming hard, THUS OBVIATING THE NECESSITY OF DRAWING THE OLD PACKING.

Orders received for the Patent Packing, also VULCANISED INDIA-RUBBER, in Sheets, Valves, &c., at the Offices,

35 CANNON-STREET, E.C. (394)

BODMER'S PATENT SAFETY VALVE.—In this Safety Valve the force which raises the cap (*a*) is derived from the steam pressure exerted upon a column of water, admitted from the boiler through the pipe (*b*), and is therefore quite independent of the steam which is about to escape. The valve is consequently exceedingly sensitive, and capable of opening to the full extent of its area, especially in the case of a sudden accumulation of steam from whatever cause.



For further information apply to Messrs. R. & L. R. BODMER, 2 Thaives' Inn, Holborn, or to Mr. WM. ROUTLEDGE, New Bridge Foundry, Salford, Manchester. (410)

DRAUGHTS of COLD AIR and DUST round Room, Office, or outside Doors and Windows EFFECTUALLY PREVENTED by GREENWOOD'S PATENT INDIA-RUBBER STOPS, the most simple and effectual method of making air-tight joints to joiners' or cabinet work, old or new. These Stops can be had any length or pattern. Self-acting Spring Stops, for the bottoms of doors.

The Trade supplied.

JOHN GREENWOOD, Patentee, 10 Arthur-street West, London-bridge. (354)

NO ADJUSTMENT REQUIRED.—You have only to place one of

LUND'S

LONDON RACK CORK SCREWS

on the neck of a bottle, and it is ready for use. Some of these Cork Screws are fitted with Patent Spring Ends to embrace the neck of the bottle, and so direct the worm through the centre of the cork.

Sold by the Patentee at 56 and 57 Cornhill, and 23 and 24 Fleet-street, London; and may be had at all Cutlers' and Ironmongers'. (254)

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THE IMPERIAL IRON TUBE COMPANY,

(SUCCESSORS TO GEORGE B. LLOYD & CO.)

GAS STREET AND BERKLEY STREET,

BIRMINGHAM,

Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES.

(193)

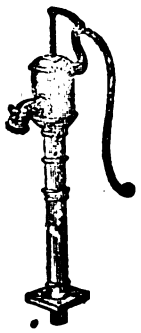
JOHN WARNER AND SONS,

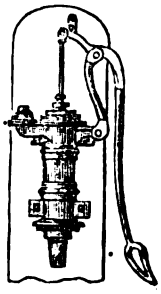
8 CRESCENT, CRIPPLEGATE, LONDON, E.C.

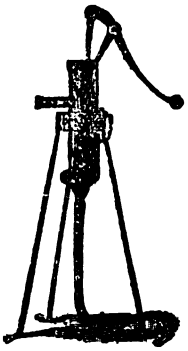
Hydraulic Engineers and Patentees of Improvements in Pumps,

BELL AND BRASS FOUNDERS TO HER MAJESTY,

Patent Vibrating Standard, Lift, and Force Pumps.







PATENT CAST-IRON PUMP fitted with J. Warner and Sons' Patent Bucket and Sucker, which cannot clog in action, for Farms, Cottages, and Wells, not exceeding 25 feet.

Dia.	Height.	£	s.
2½ in.	short ..... 1 ft. 7 in.	1	5
2½ in.	long ..... 3 ,, 3 ,,	1	10
3 ,,	..... 3 ,, 6 ,,	2	4
3½ ,,	..... 3 ,, 6 ,,	2	9
4 ,,	..... 3 ,, 6 ,,	2	18

2½ in. short, with 15 feet of Lead Pipe attached, ready for fixing 2 10

2½ in. long. do. do. 2 14

PATENT BRASS LIFT AND FORCE PUMP, on Plank, for House purposes, supply of Cisterns, &c.

	£	s.
2½ inch	6	0
3 ,, ...	7	5
3½ ,, ...	8	0

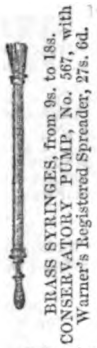
Where strength is not an object, a lighter Pump can be supplied—

2½ inch	4	15
3 ,, ...	5	15

IMPROVED LIQUID MANURE OR GENERAL PORTABLE PUMP.

These Pumps are fitted with J. Warner and Son's Patent Bucket and Valve, and cannot clog in action. The Barrel is made of Galvanized Iron, not likely to corrode, and can be raised or lowered at pleasure on the stand, the legs of which fold together, and it may be carried with ease by one man to tank or pond.

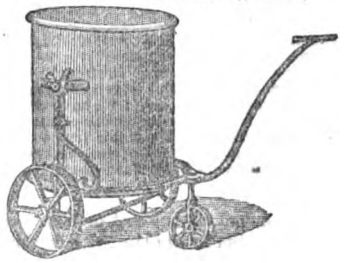
4½ in. Liquid Manure Pump, with legs, £2 15s.; 2 in. Flexible Rubber and Canvas Suction Pipe, on Wires, 2s. 2d. per foot. The Barrel is 27½ inches long, and the legs are 5 feet high. Larger sizes of the above if required.



BRASS SYRINGES, from 9s. to 18s.
CONSERVATORY PUMP, No. 567, with Warner's Registered Spreader, 27s. 6d.

Galvanized Iron Tub GARDEN ENGINE, with Warner's Registered Spreader, is strongly recommended for durability and low price, viz., £2 15s., to hold Ten Gallons. Larger sizes, in either wood or iron.

WARNER'S SWING WATER-BARROW. (Holding about 35 Gallons), £3 3s.,



is intended for all large Establishments where much watering is done by the watering-pot. By its use the Gardener will save much time and labour, particularly where the Tank, Pond, or Pump is at a distance from the garden.

WARNER'S CATTLE and SHEEP BELLS, in sets of 6, with Straps, 13s. per set.

MUSICAL SHEEP BELLS, with Straps, in sets of 6, 19s.; ditto, in sets of 8, 25s.; ditto, in sets of 12, 38s.

Bells for Churches, Chapels, Colleges, Schools, Turret Clocks, &c., cast for any size, note, or weight, singly or in peals. Tuned by machinery. Stocked and wheeled ready for fixing. Old Bells re-cast or taken in exchange.

The great 16-ton Bell, for the Houses of Parliament, was made by JOHN WARNER and SONS, 1856, under their Patent.

The above may be obtained of any Ironmonger or Plumber, in town and Country or of the Patentees and Manufacturers. (30)

WATER POISONED BY LEADEN PIPES.

"The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight. The water has cut these deep pits almost through the pipe, and not only upon the portion which we have illustrated, but has formed similar chasms throughout the entire length."—*Expositor.*

Poisoned Water Preventable.

BY THE USE OF GUTTA PERCHA TUBING.

The Gutta Percha Company have been favoured with the following letter,

From Dr. MURRAY, Hull.

"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha. Nothing can be better. I have also recommended it to others, who have adopted the expedient.

Resistance of Frost.

The Gutta Percha Company have been favoured with the following Letters in reference to the non-conducting properties of Gutta Percha Tubing, in the resistance of Frost.

From J. ARMSTRONG, Esq., M.D., Gravesend.

"My private house, which was supplied with your Gutta Percha Tubing some five or six years ago, has never required the slightest attention; and previously, there was no winter passed that we were not deluged in consequence of the bursting of the leaden pipes."

From HENRY BROWN and SONS, Western Works, 108 Rockingham-street, Sheffield.

"We have now a positive proof of the frost-resisting properties of the Gutta Percha Piping. On our premises we have a leaden Pipe and a Gutta Percha one lying side by side. The leaden one has been completely frozen up at least ten days, and the Gutta Percha one is still unaffected.

Every Variety of Gutta Percha Article.

SUCH AS

Mill-bands,	Flasks,
Tubing for Watering Gardens, &c., &c.,	Bowls,
Soles,	Chamber-vessels,
Sheet,	Galvanic Batteries,
Pump-buckets,	Toilet-trays,
Fire-buckets,	Sponge-bags,
Bottles,	Curtain-rings,
Bosses,	Talbotype-trays,
Union-joints,	Photographic Baths.
	&c., &c.

MANUFACTURED BY THE

GUTTA PERCHA COMPANY

And Sold by their

WHOLESALE DEALERS IN TOWN AND COUNTRY.

Submarine and Subterranean Telegraph Wires Insulated with Gutta Percha.

The Gutta Percha Company, Patentees,

18 WHARF-ROAD, CITY-ROAD, LONDON

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THORLEY'S FOOD FOR CATTLE.

IN acknowledging the increasing demand for THORLEY'S Food for Cattle, Mr. THORLEY in the warmest terms begs leave to thank his customers for their kind patronage, and to assure them that every endeavour on his part will be exercised to merit a continuation of their favours. The experimental evidence which is daily being received, showing the efficacy and economy of this now justly celebrated Cattle Food Condiment, is very congratulating and encouraging, especially as it is voluntarily given along with orders for fresh supplies; for practical testimony thus given must always be received as satisfactory evidence in favour of the article—a justification, as it were, for continuing its use. The experience thus being acquired is fast establishing the condimental value of THORLEY'S Food for Cattle in every town and province of the kingdom; and the more that breeders and feeders of live stock examine the subject practically, the more thoroughly are its merits appreciated by them.

"Practice with Science" is the golden motto of the Royal Agricultural Society of England, and this is just the kind of testimony now being received in favour of THORLEY'S Food for Cattle; for agriculturists and other owners of stock are, by the successful use of this condiment, beginning to experience that the value of food depends upon how it is digested. Chemically, its constituent elements may be of the highest value; but if imperfectly digested, what is its value to the animal which eats it? The testimony just referred to proves that hay and straw properly seasoned with this condiment is more nourishing than unseasoned food, although the latter may contain a much greater amount of alimentary matter; consequently the practical question arises, how many animals, including horses, oxen, sheep, pigs, poultry, and dogs, are there, whose food is imperfectly digested, because unseasoned? whose digestive and other functions are deranged by such unwholesome food—functions which might soon be restored to a healthy state by properly seasoned food? This is the grand problem, the practica solution of which is giving rise to an increased consumption of THORLEY'S Food for Cattle; and Mr. THORLEY has much pleasure in inviting special attention to it, hoping that practical men will solve this important question practically, by giving his condiment a fair trial.

Mr. THORLEY also begs leave to draw attention to the harmony which exists amongst the different examples above referred to, each corroborating the other, thus proving the soundness of his practice of seasoning the food of cattle.

Mr. JAMES BREBNER, Steward to H.R.H. the Prince Consort, states: "Through using it on my saddle-horse I have been enabled to reduce his ordinary food half a truss of hay and half a bushel of oats per week, and can testify that he has gained very much in condition."

Mr. JAMES FISHER, Farm Manager to her Grace the Duchess of Athole, says: "I have found your Food for Cattle to answer very well."

Sir DAVID CUNYNGHAME, Bart., writes: "The cows thrive and do well upon it, and the pigs have improved already wonderfully."

Sir JOHN RIBTON, Bart, expresses his approbation thus: "Relating to Thorley's Food for Cattle, I have fed with it for the last four months, and never fed with more nourishing food for cattle in general."

Sir JOHN ANDREW CATHCART, Bart., states: "I have used Thorley's Food for Cattle for three months, both for horses and cattle, and find that it has an extraordinary effect in producing condition and keeping them in a healthy state."

Sir JOHN HESKETH LETHBRIDGE, Bart., writes: "My old groom on speaking to him this morning says my horses never did better, since they have been fed upon it."

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Colonel RAMSAY writes: "I have used Thorley's Food both for horses, cattle, and swine, in all instances with great success, and can safely recommend the use of it both for economy and fattening qualities."

Lieut.-Col. MACDONALD states, in 1857: "I would be unjust if I withheld my testimony to its beneficial effects, which are most apparent in the improved condition of the horses." And in 1859: "As an instance of its efficacy I may mention that having had occasion during the autumn (1858) to hire a horse for three months, his owner said to my servant when he was returned, 'He is so much improved that I would not have known him.'"

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Captain the Hon. HUGH GOUGH writes: "I have tried Thorley's Food for Cattle, and gave two feeds per day to an aged horse, which I found it impossible to get in condition otherwise, and in six weeks he became very fat, and entirely beyond anything I could conceive."

ALEXANDER HENDERSON, Esq., the younger, of Stemster, Caithness, says: "I have used Thorley's Food with great advantage, in one case where a half-bred mare would not feed."

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THE MECHANICS' MAGAZINE

AND

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(Registered for transmission abroad.)

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Tenders, addressed to the Metropolitan Board of Works, must be delivered at the office of the Board, No. 1 Greek-street, Soho, before Four o'clock p.m. on Thursday, the 5th day of January, 1860, and no tender will be received after that hour.

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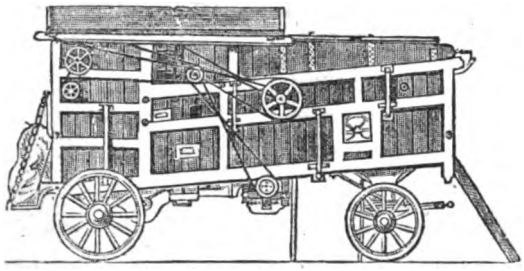

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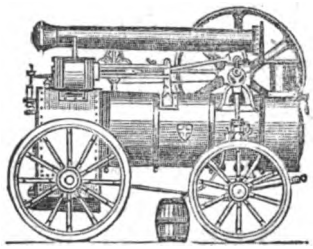

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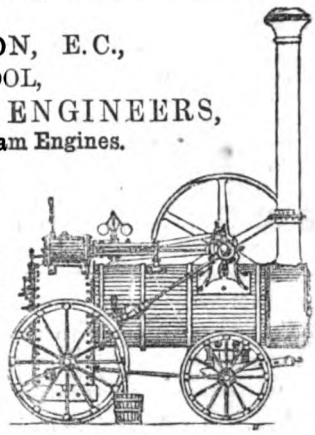

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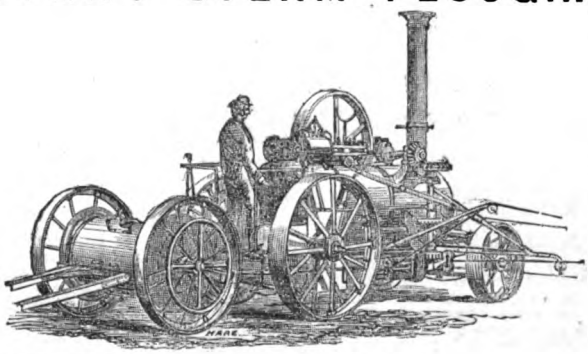

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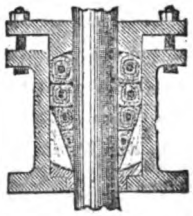

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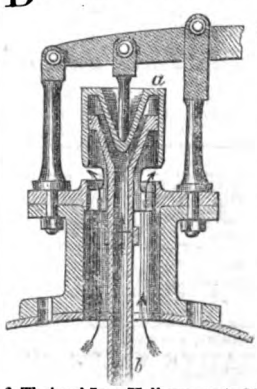

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AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.
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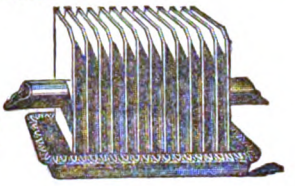

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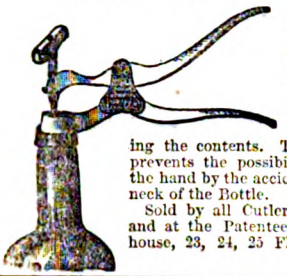

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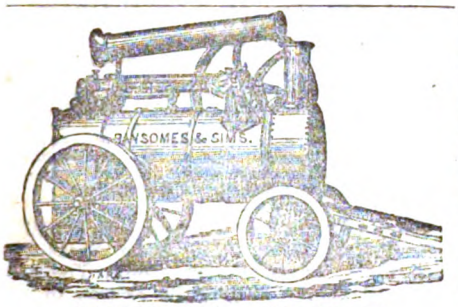

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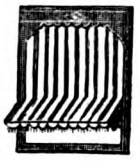

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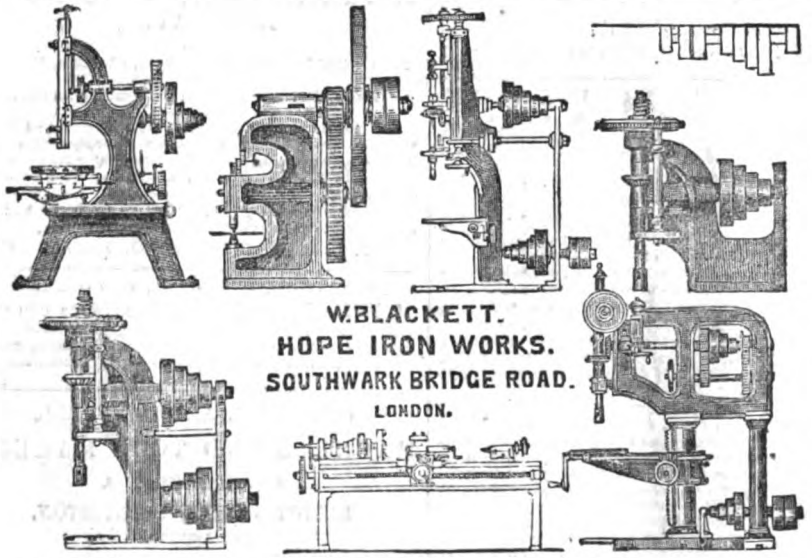

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THE GUTTA PERCHA COMPANY beg to state that the increasing demand for the Gutta Percha Strapping for Driving-bands, Lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

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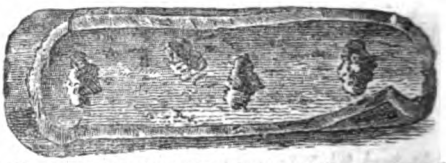
WATER POISONED BY LEADEN PIPES.



The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight.

POISONED WATER PREVENTABLE

BY THE USE OF GUTTA PERCHA TUBING.

The Gutta Percha Company have been favoured with the following letter,

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"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha Tubing. Nothing can be better. I have also recommended it to others, who have adopted the expedient."

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AND SOLD BY THEIR

WHOLESALE DEALERS IN TOWN AND COUNTRY.

(29)

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 52. [NEW SERIES.]

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London, Dec. 23rd, 1859.

		£ s. d.		£ s. d.	Dis.
IRON:					
Rails in Wales and North of England	pr. ton	6 0 0	to	6 5 0	nett
Welsh Bars, in Wales	"	5 17 6	"	6 0 0	3
Staf. Bars, at the Works	"	7 5 0	"	7 15 0	2½
" Hoops	"	8 5 0	"	8 15 0	"
" Sheets, Singles	"	8 10 0	"	9 10 0	"
" Nail Rods	"	7 5 0	"	7 15 0	"
" Boiler Plates	"	8 10 0	"	9 0 0	"
Scotch Pig, M.-Nos. Warrants, at Glasgow	"	2 15 0	"	2 16 6	nett
Do. No 1, Good Brands	"	2 16 6	"	2 18 0	"
Scotch Bars	"	7 10 0	"	8 5 0	3
Swedish Bars, in London	"	11 15 0	"	12 0 0	2½
COPPER:					
Sheet and Sheathing	per lb.	0 0 12½	"	0 0 0	3
Tough Cake and Tile	pr. ton	112 0 0	"	0 0 0	
Best Selected	"	115 0 0	"	0 0 0	"
Australian	"	114 0 0	"	115 0 0	"
South American	"	103 0 0	"	0 0 0	"
Yellow Metal Sheathing	per lb.	0 0 10½	"	0 0 0	"
STEEL:					
Swedish Keg	pr. ton	19 0 0	"	19 10 0	2½
" Faggot	"	21 0 0	"	21 5 0	"
TIN:					
English, Block	p. cwt.	6 18 0	"	0 0 0	2½
" Bar	"	6 19 0	"	0 0 0	"
Foreign, Banca	"	7 1 0	"	0 0 0	nett
" Straits	"	6 16 0	"	0 0 0	"
TINPLATES:					
Charcoal, I.C.	pr. box	1 12 0	"	1 12 6	3
Coke, I C	"	1 6 0	"	1 6 6	"
LEAD:					
Pig, English	pr. ton	22 0 0	"	23 0 0	2½
" Spanish	"	21 15 0	"	22 5 0	"
Sheet	"	22 10 0	"	23 0 0	"
SPELTER:					
On the spot	"	21 15 0	"	22 0 0	nett
For arrival	"	0 0 0	"	0 0 0	"
ZINC:					
English Sheet	"	27 0 0	"	0 0 0	1½
QUICKSILVER	pr. btl.	7 0 0	"	0 0 0	1½

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LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

BUILDING NEW QUAY, *Hillgate.*—For piling and building the new quay, and other works connected therewith, at Hillgate on the river Tyne. Plans, &c., office Mr. Johnstone, architect, 6 Clayton-street west, Newcastle. A copy furnished for £1, which will be returned on receipt of the tender. Tenders Mr. J. W. Swinburne, town clerk, Gateshead January 7th.

CHURCH, *Bray.*—For the erection of a new parish church at Bray. Plans, Rev. M. Whateley, or office of Mr. William Slater, architect, Carlton Chambers, Regent-street, London. Tenders, Dec. 31st.

SCHOOL, *Prestigue, Radnorshire.*—For the building of a school-room on the site of the present school-room, Prestigue. Plans, &c., at Mr. Mansfield's, architect, Kington, Herefordshire. The architect will supply quantities, the building to be of brick, with Bath stone dressings. Tenders, January 3.

DESIGNS AND ESTIMATES FOR CEMETERY, *Liverpool.*—For designs and estimates for enclosing, laying out, and embellishing the new cemetery for the parish of Liverpool. 1. A ground plan of the site, showing the roads and walks, the land to be set apart for ornamental planting; the sites of the chapels, the proposed general division of the cemetery, and also its division into grave spaces, lines of drainage, sites of the lodges, stove yards, offices, &c. 2. Sections showing earthwork for the rearrangement of the surface, and the depth gradients, and dimensions of sewers and drains. Site includes 90 acres. Premiums of £100 for the best design; one of £50 and another of £30 for the second and third best. Competitors to state terms on which they will carry out the works. Plans, &c., of site, to the clerk. Estimates and plans to have a motto and a sealed envelope to contain a similar motto to that on the plan. To be endorsed "Plan for Liverpool New Cemetery." To E. Harvey, Esq., Clerk to the Liverpool Burial Board, 12 Castle-street, Liverpool, February 14th.

RAILWAY, *Scotland.*—For the works on the Auchterhouse deviation of the Dundee and Newtyle Railway, to be called the Auchterhouse contract; and for those of the line by Lochee, to be called the Lochee contract. The former is about three miles, and the latter about five miles in length. The rails and the sleepers supplied by the company. Drawings and specifications of Messrs. B. and E. Blyth, 135 George-street, Edinburgh; from whom duplicate schedules may be obtained on payment of 10s. Forms of tender from the Engineers, or the Secretary. Tenders with the Secretary, Dundee, January 3. Contractors, or their agents, to attend at the company's offices, at noon, on January 5.

DRY STONE DYKES, *Scotland.*—For building about four miles of dry stone dykes in the parish of Dundyre, Upper Ward of Lanarkshire. Specifications at the Stonypath; and tenders can be given in to Mr. Brown, forester on the Cornwall estate, or to Dr. Aiton, Dolphinton, by the 9th January.

STEAM-ENGINE, BUILDINGS, &c., *Dublin.*—For the erection at the Richmond District Lunatic Asylum, Dublin, of a new drying-room and wash-house buildings, additional airing yards and sheds, dead house, new water closets, &c., and new drains to the old asylum, forming a refectory, and various other alterations and additions; also the erection of a steam boiler and four horse-power steam-engine for pumping water to the establishment, with a considerable length of iron main pipes. Plan, and specification for the works, at the Asylum, North Brunswick-street; and further particulars from Mr. Wilkinson, architect, 49 Westland Row. Tenders to the Governors before 4 o'clock, January 9.

CHURCH WORK, *Ireland.*—For extensive works at the church of Fenagh, county Carlow, and for repairing Howth, county Dublin, to the plan and specification at the resident ministers of the parish. Proposals to the Ecclesiastical Commissioners for Ireland, Dublin, Dec. 29.

PARSONAGE HOUSE, *Hyde.*—Drawings and specifications in the vestry room of St. George's Church, Hyde. Tenders, 31st inst., Rev. A. Read, incumbent, Wood End, Hyde.

SCHOOLS, SCHOOL-HOUSE, AND OUTBUILDINGS, *Otley, Yorkshire.*—For the building of boys' and girls' schools, &c. The whole of the walls to be of stone. Plans, &c., offices Messrs. J. Child and Son, 23 Park-row, Leeds, to Dec. 27.

WAREHOUSES, *Bradford, Yorkshire.*—For the masons', joiners', plasterers', plumbers', glaziers', slaters', painters', and ironfounders' works required in the erection of three stuff warehouses, Foster's Buildings, in Well-street, Bradford. Drawings, &c., E. Milnes, 30 Hall Tugs.

POLICE STATION, *Birmingham.*—To be erected in Ladywood lane. Drawings, conditions, and copies of quantities, and form of tender, office of Mr. E. Holmes, architect, 25 Temple-row, Birmingham. Contractors wishing to compete to send in their names to the architect, Dec. 31st. Tenders, January 16th.

RAILS, *Scotland.*—For 600 tons for the Dundee and Newtyle Railway, to be delivered at Dundee during the months of April, May, June, and July, 1860. Specifications, Messrs. B. and E. Blyth, engineers, Edinburgh. Tenders with Mr. R. Alison, Secretary, Dundee, Jan. 3.

ELM TIMBER, *Navy.*—For supplying H. M. Dockyards with 5,320 loads of English elm timber, and 28 elm trees for pumps fitted between the middle of November last and the end of February next, and to be delivered (at prices including carriage and all other expenses) by the 30th NOV., 1860. Tenders may be made for the supply of any one or more of the yards, or for the whole of them. A distribution and a form of the tender may be obtained at the office of the Storekeeper-General, Somerset-place. Tenders to Jan. 10, with names of sureties to the extent of £1 per load.

PAVING STONES, CURBING, AND CHANNELLING, *Waterlooswith-Seaforth.*—For 4,000 tons of square-set paving stones, 12,000 yards of curbing, and 12,000 yards of channelling. Samples and prices to be sent to the office of the Local Board, Jan. 2, Great Georges-road, Waterloo, near Liverpool.

PLAN OF TOWN HALL, COVERED MARKET, &c., *Bishop Auckland.*—£20 for the best plan. Full particulars, W. B. Cherrett, Secretary to the Directors of the Market Company. Plans to Feb. 11.

RAILWAY AGENT, *India.*—The Directors of the Bombay, Baroda, and Central India Railway Company desire to engage the services of a gentleman thoroughly competent to audit the railway engineer's accounts, conduct the correspondence, and generally to assist the managing agent, and be prepared to proceed to India immediately. Salary £600 per annum. Applications, stating general qualifications and railway experience, age, &c., Mr. C. H. Kennedy, offices, 10 Liverpool-street, New Broad-st., not later than the 28th inst.

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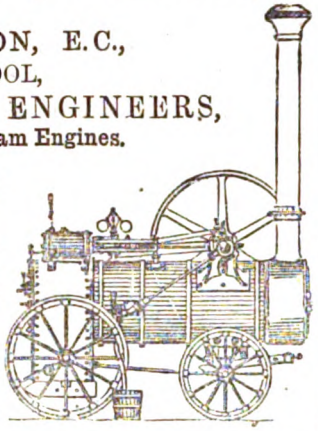

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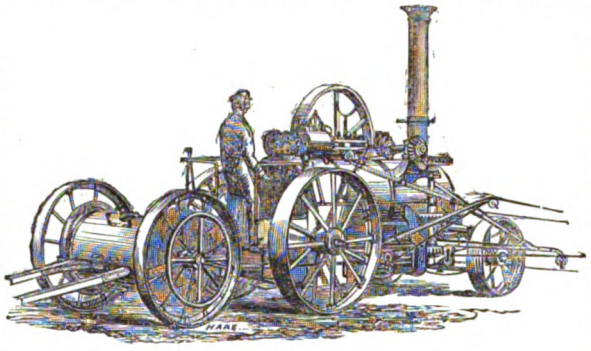

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ADVANTAGES.—A more perfect vacuum is obtained, Friction reduced, great saving in oil and tallow, and the Packing is gradually and completely worn away without becoming hard, THUS OBVIATING THE NECESSITY OF DRAWING THE OLD PACKING.

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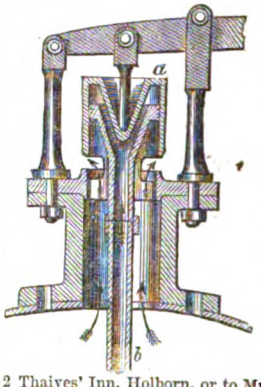
35 CANNON-STREET, E.C. (394)

BODMER'S PATENT SAFETY VALVE.—In this Safety Valve the force which raises the cap (*a*) is derived from the steam pressure exerted upon a column of water, admitted from the boiler through the pipe (*b*), and is therefore quite independent of the steam which is about to escape. The valve is consequently exceedingly sensitive, and capable of opening to the full extent of its area, especially in the case of a sudden accumulation of steam from whatever cause.



For further information apply to Messrs. R. & L. R. BODMER, 2 Thaives' Inn, Holborn, or to Mr. WM. ROUTLEDGE, New Bridge Foundry, Salford, Manchester. (410)

DRAUGHTS of COLD AIR and DUST round Room, Office, or outside Doors and Windows EFFECTUALLY PREVENTED by GREENWOOD'S PATENT INDIA-RUBBER STOPS, the most simple and effectual method of making air-tight joints to joiners' or cabinet work, old or new. These Stops can be had any length or pattern. Self-acting Spring Stops, for the bottoms of doors.

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LONDON RACK CORK SCREWS

on the neck of a bottle, and it is ready for use. Some of these Cork Screws are fitted with Patent Spring Ends to embrace the neck of the bottle, and so direct the worm through the centre of the cork.

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VINEGAR.—Patronised by Her Majesty's Government.

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Families, by using this delicious VINEGAR, insure purity and effect a saving of 50 per cent. See "Report of Dr. Letheby, City Officer of Health, Dr. Hassall, of the 'Lancet' Commission, and others." Sold by the Trade, in Bottles, labelled and capsuled. Wholesale—63 King William-street, London-bridge, E.C. Six Quart Samples sent free to any Railway for 3s. 6d. (216)

HORIZONTAL HIGH-PRESSURE STEAM ENGINES FOR SALE.

One of 8-horse power, 8in. cylinder, and 18in. stroke.
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Two of 12-horse power, 12in. cylinder, and 24in. stroke.
One of 14-horse power, 12in. cylinder, and 36in. stroke.
Two of 14-horse power, 14in. cylinder, and 24in. stroke.
One of 16-horse power, 14in. cylinder, and 36in. stroke.
Two of 30-horse power, 20in. cylinder, and 36in. stroke.

The above Engines are quite new, of superior manufacture and finish, and are to be sold at very low prices.

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Not only Deodorizes but Disinfects perfectly, and DESTROYS FOR EVER the cause of infection.

Is not poisonous, as it may be used to purify water. Evolves no noxious or unpleasant gas. Cannot be mistaken for any other fluid, thereby preventing death and disease; and is therefore the best, safest, cheapest, and most pleasant disinfectant ever introduced.

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Sold in Quart Bottles, 4s.; Pints, 2s.; Half-pints, 1s. and in bulk; 10s. per Gallon.

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FOR

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The various parts are of the best materials and workmanship, are not liable to get out of order, and can be worked with a small degree of attention by a farm-servant or labourer without materially interfering with his other duties.

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MACHINE AND TOOL MAKERS,

AND MILLWRIGHTS,

ELLIOT WORKS, FINNIESTON,

GLASGOW.

Manufacturers of Engineers' Tools of every description, Screwing Apparatus of standard gauge, Boring Grabs, &c. (303)

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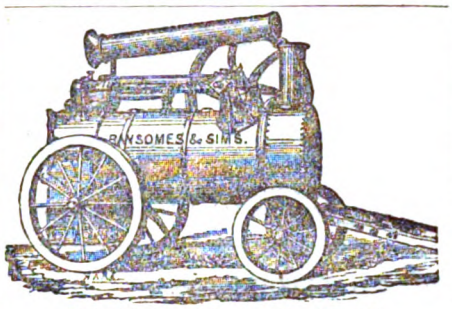

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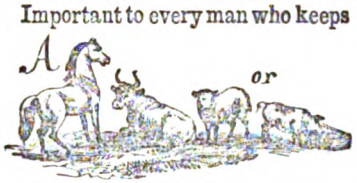

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Carriage paid to any Station.

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WORKING SECTIONAL MODELS OF STEAM ENGINES, IN WOOD OR METAL,

10½ ST. JAMES'S PLACE, HAMPSTEAD ROAD.

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GLENFIELD PATENT STARCH;

USED IN THE ROYAL LAUNDRY,

AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.

WHEN YOU ASK FOR

GLENFIELD PATENT STARCH,

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as inferior kinds are often substituted.

Sold by all Chandlers, Grocers, &c., &c.. (75

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CORN, SEED, AND MANURE DRILLS, OF ALL KINDS,
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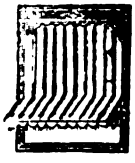

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LEISTON WORKS, SAXMUNDHAM, SUFFOLK,

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"The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight. The water has cut these deep pits almost through the pipe, and not only upon the portion which we have illustrated, but has formed similar chasms throughout the entire length."—*Expositor*.

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Every Variety of Gutta Percha Article.

SUCH AS

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Soles,
Sheet,
Pump-buckets,
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Sponge-bags,
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The Gutta Percha Company, Patentees,

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(54)

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THE MECHANICS' MAGAZINE

AND

Journal of Engineering, Agricultural Machinery, Manufactures, and Shipbuilding.

(Registered for transmission abroad.)

[EDITED BY R. A. BROOMAN AND E. J. REED.]

VOL. 2.—NO. 53. [NEW SERIES.]

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PRICE, FOURPENCE. BY POST 5d.

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MACHINERY of all Kinds DRAWN and ENGRAVED on WOOD, with the greatest accuracy of detail and Artistic Effect, by

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2 Walbrook-buildings, City, E.C.

Artists sent to all parts of the United Kingdom, if required. (313)

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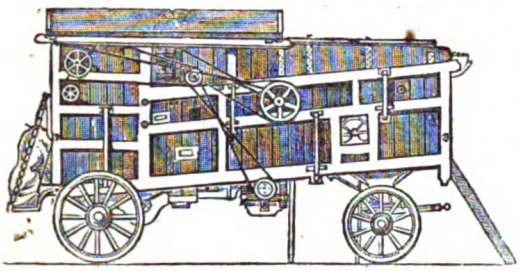

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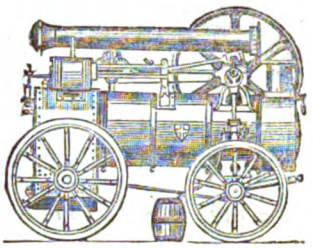

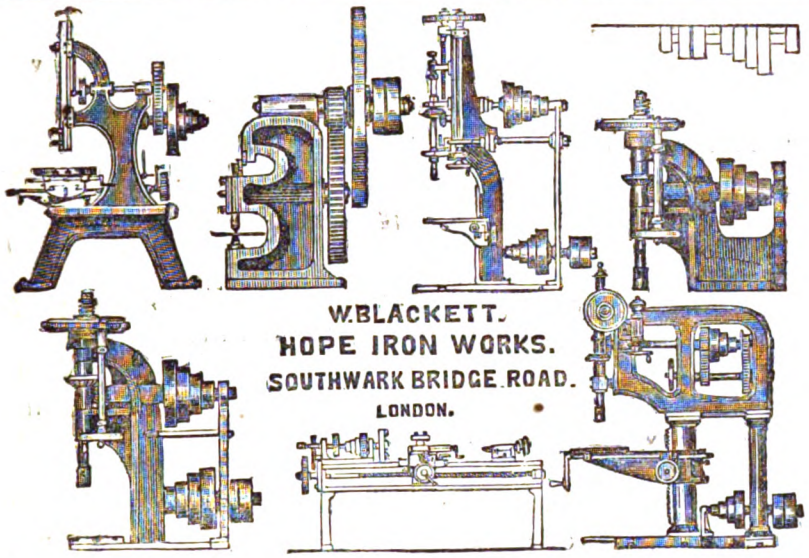

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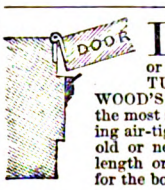

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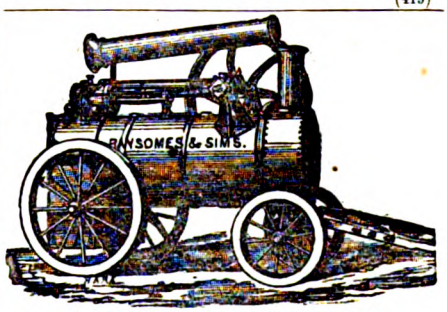

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Thomas Bazley, Esq., M.P.	Benjamin Hick, Esq.
James A. Turner, Esq., M.P.	John Penn, Esq.
Richard Cobden, Esq., M.P.	John Boyd, Esq.

Mr. DAVID MORRIS, Secretary, 1 Market Place, Manchester.

At a Meeting of the Committee, held in the Town Hall, Manchester, the Mayor in the Chair:—
Resolved—"That a Circular be prepared and signed by Mr Fairbairn as Chairman of the Committee, appealing to all interested in the subject of iron manufacture, for co-operation and assistance to the CORT FUND, and that Mr. D. Morris, Secretary, issue such Circular, accompanied by blank forms for Subscriptions forthwith, so as to complete the labours of the Committee as early as possible.
"That when the Subscription List is completed, the sum raised shall be invested in the purchase of Annuities, or some other form of securing the comfort of the declining years of the survivers of the CORT FAMILY."
Considering the services rendered to the country by the inventions of HENRY CORT, and the present destitute condition of his Son and Two Daughters, all of them upwards of 70 years of age, the Committee look forward with confidence to all those interested in, or benefitted by, his inventions to assist in its efforts towards raising a sum sufficient for their future maintenance and support.

Subscriptions already received.

W. Fairbairn, Manchester	£100	0
Thomas Bazley, M.P., Manchester	50	0
Joseph Whitworth, Esq.	50	0
Messrs. Hick and Co., Bolton	50	0
,, Knight and Wood, Bolton	10	0
,, Dobson and Barlow ,, ...	5	0
,, Rothwell and Co., ,, ...	5	0
,, Beyer, Peacock, and Co., Manchester	50	0
,, Peel, Williams, and Peel ,, ...	10	0
Sir P. Fairbairn, Leeds	10	0
Messrs. E. T. Bellhouse and Co., Manchester	10	0
,, P. R. Jackson and Co.	10	0
,, R. Johnson and Bros.	10	0
,, Roe and Boyd, Oldham	3	3
,, W. Baird and Co., Glasgow ...	10	0
Joseph Webb, Esq., Bury	5	0
Messrs. H. Lees and Sons, Ashton	10	0
Miss B. Coutts, London	20	0
B. Goodfellow, Esq., Hyde	20	0
John Penn, Esq., London	50	0
Messrs. Hird, Dawson, and Hardy, Low Moor Iron Works	50	0

(422)

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LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
Nov. 25,	4216	J. S. Margetson, Cheapside	Strap.
,, 26,	4217	E. A. S. Burgess, Strand.	Bottle.
,, 29,	4218	Howell, James and Co., Regent-street	Blotting Book.
Dec. 1,	4219	J. Fairley, Stechford	Perforated Plate.
,, 6,	4220	J. Seton, Gowran	Harrow.
,, 20,	4221	Atkin and Maxfield, Nottingham	Draught Preventer.
,, 22,	4222	J. Brooks, Vere-street.	Case.
,, 27,	4223	Muir and McSlivham, Glasgow	Picker.

PROVISIONAL REGISTRATIONS.

Dec. 6,	1123	Fenn and Hughes, Charing-cross	Parasol.
,, 7,	1124	H. Bex, Lamberhurst	Dibble.
,, 21,	1125	W. Saul, Islington	Case.
,, 22,	1126	W. Ryder, Birmingham.	Fishing Reel.
,, 27,	1127	H. Pelling, Burton Crescent	Overcoat.

LIST OF MISCELLANEOUS TENDERS INVITED, AND ENGAGEMENTS OPEN.

The tenders and vacancies which appear in this weekly list are not repeated in succeeding numbers.

TELESCOPES, *Navy.*—For supplying Her Majesty's dockyard, at Woolwich, with 300 telescopes within three months from the date of contract, and such further quantities under a contract for twelve months certain, and afterwards until the expiration of six months warning, such further supplies to be delivered within six weeks of each demand, Pattern, conditions, and form, office of storekeeper general, Somerset-place. Tenders to January 3. Attendance of party or agent necessary, as also the names of two sureties for £200.

MARKS OF DISTINCTION, *Navy.*—For supplying and delivering into Her Majesty's victualling stores at Deptford, Gosport, and Plymouth, all such marks of distinction for twelve months and further until three months notice. Patterns, Somerset-place, and at the victualling yards of Gosport and Plymouth, where also see modification of conditions of contract, and obtain forms. Tenders to January 5. Attendance not necessary.

PIG LEAD AND COPPER, *India Board.*—For supplying the required quantity of pig lead and copper (two contracts). Tenders to the secretarie's office, January 3.

STORES, *River Wear Commissioners.*—For the supply during the ensuing year of *A*, malleable and cast-iron; *B*, nails, hardware, &c.; *C*, brass castings; *F*, coals. Forms of application at the engineer's office, to be filled up, signed, and sent to the office January 3.

CANVAS HOSE, *Liverpool.*—For 300 yards of best 2½-inch canvas hose, for hydrants, &c. Sealed tenders endorsed "Tender for hose," to be left with sample of article proposed to be supplied, at office of Mr. H. J. Hagger, vestry clerk, Liverpool. January 5.

EPISCOPAL PALACE, *Gloucester.*—For the rebuilding of the Episcopal Palace, Gloucester. Application by letter to Mr. Christian, architect, 10 Whitehall-place, London, S.W., immediately.

EPISCOPAL PALACE, *Bangor.*—For the rebuilding of the Episcopal Palace. Application by letter immediately to Mr. Christian, 10 Whitehall-place, London, S.W.; references will be required. Bills of quantities, Messrs. Bunker and Goodman, surveyors, 8 St. Martin's-place, Charing-cross, London, W.C.

CHAPEL, *Portland Town.*—For the erection of new galleries, staircases, &c., in Victoria Terrace Chapel. Drawings, &c., office of Mr. J. Tarring, 26 Bucklersbury, City. Tenders January 6. Half-a-guinea will be charged for the quantities.

GOODS WAREHOUSE, *North Eastern Railway.*—For the construction of a goods warehouse at the Tyne dock. Plans, &c, at engineer's office. Central station, Newcastle. Tenders to January.

CEMETERY, *Bath, Parish of St. Saviour's.*—For the whole or separate portions of the necessary works for the build- and erection of chapels and entrance gates, with the enclosing, laying out, draining, and embellishing the burial ground attached thereto. Drawings and specifications, office of Messrs. Hickes and Isac, architects, 13 Northgate-street, Bath. Tenders, Jan. 28.

SEWERAGE, *Wakefield.*—For the sewering and paving of Milton-street, within the district of the Local Board of Health. Plans, &c., of Mr. T. Dale, C.E., Borough surveyor, Barstow-square, Wakefield Tenders, Jan. 2.

UNDERPINNING SEWER, *Paddington.*—For underpinning about 2,000 feet of brick sewer in Bishop's-road and Westbourne-grove, together with other works incidental thereto. Specifications, &c., the surveyor, vestry hall, Harrow-road. Tenders, Jan. 2.

ROAD, BRIDGES, &c., *Hilsea, near Portsmouth.*—For certain earthworks, widening and deepening channels, forming roads, bridges, &c. Attendance required at the Royal Engineer's office, Galcombe-house, Hilsea, 4th Jan., at two o'clock, to appoint a surveyor to take out the quantities in conjunction with the Government surveyor. Each party will be required to pay the sum of 8 guineas for the quantities.

PLANS FOR LAYING OUT LAND FOR BUILDING, *Newport, Salop.*—The Newport Town and Marsh Trustees will pay £10 for the plan they may consider the best to lay out for building sites, several pieces of land in the Marsh. Particulars, Mr. H. Heane, Newport, to whom plans must be delivered with motto and the name in a sealed envelope, March 1.

PLANS FOR LAYING OUT LAND FOR BUILDING, *Rhyl.*—For a good block plan as to the most advantageous manner of laying out for building 4 acres of land, with considerable frontage to the sea at Rhyl. A plan and section of the site, &c., Messrs. Churton, auctioneers, Chester. Twenty guineas for the best, and ten guineas for the second best plan. The architect to furnish designs of the elevation of such houses as he recommends.

SURVEYOR, *Newport, Monmouthshire.*—Salary £200 per annum and office. Must be an engineer, and a knowledge of architecture would be desirable. To act as inspector of gas metres. Whole time. Applications to the town clerk, Jan. 2.

FURNACE MANAGER.—One who thoroughly understands his business. Apply by letter, A. X., Post-office, West Bromwich.

MOULDERS.—Four good hands for jobbing and stove grate work. Apply to Baker and Co., Bishop-street, Birmingham.

PRICES CURRENT OF METALS.

London, Dec. 30th, 1859.

IRON:		£ s. d.		£ s. d.	Dis. p.ct.
Rails in Wales and North of England	pr. ton	5 15 0	to	6 0 0	nett
Welsh Bars, in Wales	,,	5 17 6	,,	6 0 0	3
Staf. Bars, at the Works	,,	7 5 0	,,	7 15 0	2½
,, Hoops	,,	8 5 0	,,	8 15 0	,,
,, Sheets, Singles	,,	8 10 0	,,	9 10 0	,,
,, Nail Rods	,,	7 5 0	,,	7 15 0	,,
,, Boiler Plates	,,	8 10 0	,,	9 0 0	,,
Scotch Pig, M. Nos. Warrants, at Glasgow	,,	2 18 6	,,	2 18 9	nett
Do No 1, Good Brands	,,	2 19 0	,,	03 0 3	,,
Scotch Bars	,,	7 10 0	,,	8 5 0	3
Swedish Bars, in London	,,	11 10 0	,,	12 0 0	2½
COPPER:					
Sheet and Sheathing	per lb.	0 0 12½	,,	0 0 0	3
Tough Cake and Tile	pr. ton	112 0 0	,,	0 0 0	
Best Selected	,,	115 0 0	,,	0 0 0	,,
Australian	,,	113 0 0	,,	117 0 0	,,
South American	,,	103 0 0	,,	106 0 0	,,
Yellow Metal Sheathing	per lb.	0 0 10½	,,	0 0 0	,,
STEEL:					
Swedish Keg	pr. ton	19 0 0	,,	19 10 0	2½
,, Faggot	,,	21 0 0	,,	0 0 0	,,
TIN:					
English, Block	p. cwt.	6 18 0	,,	0 0 0	2½
,, Bar	,,	6 19 0	,,	0 0 0	,,
Foreign, Banca	,,	7 0 0	,,	7 1 0	nett
,, Straits	,,	6 16 0	,,	0 0 0	,,
TINPLATES:					
Charcoal, I.C.	pr. box	1 12 0	,,	1 13 0	3
Coke, I C.	,,	1 6 0	,,	1 7 0	,,
LEAD:					
Pig, English	pr. ton	22 0 0	,,	23 0 0	2½
,, Spanish	,,	21 5 0	,,	22 5 0	,,
Sheet	,,	22 10 0	,,	23 0 0	,,
SPELTER:					
On the spot	,,	21 17 6	,,	22 0 0	nett
For arrival	,,	21 17 6	,,	22 0 0	,,
ZINC:					
English Sheet	,,	27 0 0	,,	0 0 0	1½
QUICKSILVER	pr. btl.	7 0 0	,,	0. 0 0	1½

LAWRIE AND HAGGER, Metal Brokers
33 Lombard-street, E.C.

TO MANUFACTURERS, THE ENGINEERING, MECHANICAL, & BUILDING TRADES GENERALLY.

MESSRS. BOOTH & CO., AUCTIONEERS and BUILDERS' SALESMEN, having opened Registers for Public and Private Sales of all kinds of JOB LOTS, Surplus Stock, Stores, Tools, Implements, &c., &c., (either Old or New,) beg to call the attention of all parties to the only medium established of the kind, and to state that they are prepared to receive consignments of any weight, bulk, or value, and of any class of Goods for immediate Sale. Full particulars may be had for two stamps, at the BUILDING TRADES REGISTRY OFFICES, (established 1857,) 13 EASTCHEAP, LONDON, E.C. The Public Sales by Auction are held Weekly, on EVERY TUESDAY, at ONE O'CLOCK, and for the present at the BUILDERS' SALE GROUNDS, (established 1858,) 23 and 24 MARYLEBONE ROAD, REGENT'S PARK, W. Catalogues by Post for One Stamp. Advances on New Goods. All communications are held private and confidential. (204)

LITHOGRAPHY AND WOOD ENGRAVING.

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EMBARRASSED AFFAIRS—DISPUTED OR NEGLECTED ACCOUNTS.

IN all such cases, the best Advice and Assistance, whether Legal or otherwise, may be obtained from

MR. WILLIAM FISHER,
Accountant, Arbitrator, and Legal Agent, 2 Portsmouth-street, Lincoln's Inn Fields. (349)

CAUTION.

TO ARCHITECTS AND BUILDERS.—In consequence of numerous complaints, the Patentee begs to inform the above, that all genuine SMITH'S PATENT DOOR SPRINGS, for Swing Doors, are stamped with Name and Address, thus—SMITH, Patentee, 69 Princes-street, Leicester-square, London; and that Springs thus marked are warranted. SMITH'S PATENT WEATHER-TIGHT CASEMENT FASTENING AND SILL-BARS are admitted by all to be the most perfect invention for the purpose. Diagrams and List of Prices on application. (143)

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Two of 12-horse power, 12in. cylinder, and 24in. stroke.
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ESTABLISHED 50 YEARS.—I. ASTON'S BOX AND IVORY RULE MANUFACTORY, No. 25 Old Compton-street, Soho. Surveyors' and Architects' Drawing Scales, T-squares, Angles, Curves, Parallel Rules, Marquois Scales, Horse Measures, Standards for measuring Soldiers, Measuring Tapes, and every description of English and Foreign Rules and Scales made to order. All sorts of Rules repaired. Wholesale and Retail. (390)

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WORKING SECTIONAL MODELS OF STEAM ENGINES, IN WOOD OR METAL,

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Mr. BLOOMFIELD, having had many years' experience in making models for the late firm of Watkins and Hill, of Charing-cross, can confidently guarantee accuracy of workmanship at very reasonable charges. (329)

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USED IN THE ROYAL LAUNDRY,

AND PRONOUNCED BY HER MAJESTY'S LAUNDRESS TO BE THE FINEST STARCH SHE EVER USED.

WHEN YOU ASK FOR

GLENFIELD PATENT STARCH,

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as inferior kinds are often substituted.

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WELLS & HALL are prepared to Insulate Conductors of all sizes for Submarine Cables or any other purpose where Insulation is required for Telegraphic Communication. The insulating medium is pure india rubber applied by their patent machinery.

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TO ENGINEERS, MARINE, LOCOMOTIVE, AND OTHER BOILER MAKERS; IRON-SHIP AND BRIDGE BUILDERS; GAS AND RAILWAY COMPANIES, &c.

WARNE'S NEW PATENT FERRUGINOUS CEMENT PACKING, applicable to Steam, Air, Water, and Gas Joints of all descriptions, Water Tanks and Repairs of Boilers; for Railway purposes, to Chairs and Fish-tail Joints, Turn Tables and Bridge Girders, and to the Construction of Iron Bridges generally, and of Iron Ships.

Among the many important advantages of the PATENT FERRUGINOUS CEMENT PACKING, are, Indestructibility by either Fire, Steam, Water, or Gas; Instant and Ready Application; and great Economy of Time and Labour by its use for Joints, &c., in place of the ordinary Iron Cement. For all Permanent Joints it can be made to set as hard as Iron, and it will Expand and Contract in the same ratio as the metal itself. For all other Joints it can be made sufficiently elastic for the purposes to which India-rubber or other Packing is applied.

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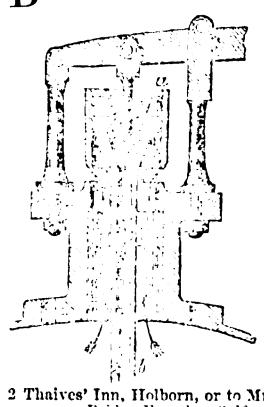

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FOR THE

Exhibition of Series of Stereoscopic Views, will be found the most convenient mode of exhibiting Ornamental Designs and Agricultural and other Machinery which has yet been introduced. Those possessing Stereoscopic Pictures of their Manufactures are invited to inspect samples at

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TO ENGINEERS & MANUFACTURERS.—INDIA-RUBBER WASHERS, Valves, Engine Packing, Fire-engine and Factory Hose-pipes, Gas Tubing, &c.

JAMES LYNE HANCOCK,
Vulcanized India-Rubber Works, Goswell-mews, and
8 Goswell-road, London, E.C. (258)

THORLEY'S FOOD FOR CATTLE.—Every person having an interest in domestic or farm animals should obtain a supply of this celebrated and economical food, which will prove invaluable during the approaching season. For keeping horses in good condition, it is unequalled. Pigs fatten with surprising rapidity upon it, and their flesh increases in flavour and value. Cowkeepers will find great advantage in the increased quantity and improved quality of the milk during its use. All animals are benefited by it. A pamphlet on this interesting subject, accompanied by Testimonials from the principal Nobility, Gentry, and Agriculturists, forwarded on application. In Casks containing 448 Feeds (Measures enclosed), Price 50s., carriage paid to any Railway Station in the United Kingdom. Post Office Orders payable to JOSEPH THORLEY 77 Newgate Street, London.

N.B.—The public are cautioned against being imposed upon by worthless imitations. (132)

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THE IMPERIAL IRON TUBE COMPANY,

(SUCCESSORS TO GEORGE B. LLOYD & CO.)

GAS STREET AND BERKLEY STREET,

BIRMINGHAM,

Manufacturers of Wrought Iron Tubes & Fittings,

FOR GAS, STEAM, AND WATER.

PATENT GLASS ENAMELLED AND GALVANIZED TUBES,

AND

LAP-WELDED IRON BOILER TUBES.

(193)

CLAYTON, SHUTTLEWORTH, AND CO.,

OF LINCOLN,

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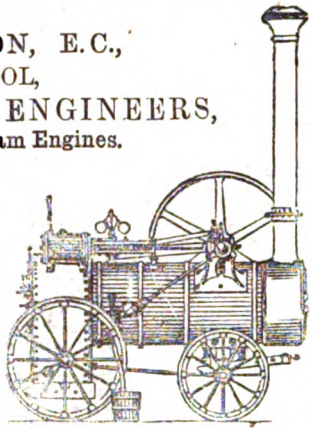
AGRICULTURAL AND GENERAL ENGINEERS,

And Manufacturers of Portable and Fixed Steam Engines.



Combined Threshing Machines, which dress the corn ready for market at one operation. Grinding Mills, Saw Benches, Pumps for Irrigation and Mining purposes, with all necessary gearing for being driven by steam power. Full particulars and estimates given on application to the above address.

C. S. and Co.'s PORTABLE STEAM ENGINES are adapted for every purpose to which steam-power can be applied. When intended for winding, they are fitted with reversible link action and winding gear. They are easy of removal, as may be seen by the engraving, and can be set to work immediately on arrival.

C. S. and Co. are now doing an extensive foreign and colonial business, and are prepared to send off engines and machinery of the before-mentioned kinds in a few days from the date of order. They would also call attention to the important *reduction in prices* made for the new year.

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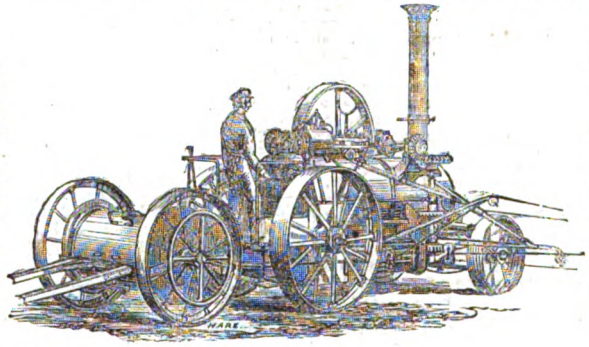
ENGINES purchased for Steam Ploughing can also be used for any other operation the Farmer may wish. They are all made to move themselves by Steam from field to field, or place to place, requiring but *one or two* horses in the shafts to steer them. The Ploughs are so constructed as to be adjusted to any width of Furrow, and they can also be used as a Subsoiler, Trenching-Plough, and Scarifier.



The above is a Cut of Fowler's Engine, Windlass, and Water-Cart.

For further particulars, Illustrated Catalogues, and Prices, apply to

JOHN FOWLER, JUN., 28 CORNHILL, LONDON, E.C.

(388

THE LONDON

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(LIMITED,)

26 GREAT GEORGE STREET, Westminster, S.W.

(MANAGER—Mr. WOODCOCK.)

Churches, Greenhouses, Offices, and Buildings of every description warmed by means of a modification of the plan successfully used during the last five years by Mr. Goldsworthy Gurney in both Houses of Parliament.

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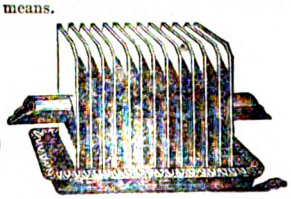

The Horticulturist will find herein an instrument of new and important powers.

The apparatus may be seen in ST. PAUL'S CATHEDRAL, the various offices of the "Department of Science and Art," and in many churches and other buildings.

Particulars and Testimonials forwarded on application.

(12)

IMPORTANT TO MANUFACTURERS MILL OWNERS, &c.

GUTTA PERCHA MILL BANDS.

THE GUTTA PERCHA COMPANY beg to state that the increasing demand for the Gutta Percha Strapping for Driving-bands, Lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

Their durability and strength—permanent contractability and uniformity of substance—their non-susceptibility of injury from contact with oils, grease, acids, alkalies, or water—and the facility with which the only joint required can be made in bands of from 200 to 300 feet long—render them superior to leather for almost all working purposes, and decidedly more economical.

TESTIMONIALS.

IMPORTANT ANNUAL SAVING.

From TRUMAN, HANBURY, BUXTON, & Co., Brewery London.

"In reply to your inquiry, we have much pleasure in bearing our testimony to the advantages, both as regards economy and saving of time, effected by the use of your Patent Gutta Percha Bands in lieu of Leather Straps. The stoppage of one portion of our works through the failing of the leather strap used to be of daily occurrence—but with this annoyance we are now never troubled. We have had these straps in operation for nearly three years, and are assured by our Engineer that *they effect a saving to us of at least* THIRTY POUNDS *a year*."

From JAMES ABERNETHY & Co., Fury Hill Foundry Aberdeen.

"We have now had Gutta Percha Bands working here *for three years*. One of them has been driving the fan blast for our smith's shop for all that time, and for anything we see, may drive it as long again. The speed of the fan is but 1,200 per minute. We have used them with complete satisfaction, driving circular saws, and in some cases where leather bands would have been quite inapplicable from damp. We have uniformly endeavoured to have the drums and pulleys so proportioned to the strain, as that there is no chance of the band slipping; and with this precaution, and taking care in using *cross bands that they do not rub*, we are quite satisfied that they are superior in every respect to leather—stronger at the same weight, and keeping quite straight in working—requiring no lacings, and very seldom any repairs."

WATER POISONED BY LEADEN PIPES.

The above engraving represents accurately a section of a leaden pipe, which was employed for a short time in conveying water from a well on the grounds of Mr. Dick, of Bonchurch, Isle of Wight.

POISONED WATER PREVENTABLE

BY THE USE OF GUTTA PERCHA TUBING.

The Gutta Percha Company have been favoured with the following letter,

From Dr. MURRAY, Hull.

"It is impossible to conceive of anything more injurious or destructive to the health of the community than the use of *leaden pipes* for the conveyance of water. The poisonous salts of lead thereby communicated are most insidious and subtle. I hail with gratitude the substitution of Gutta Percha Tubing. I have had the leaden pipe of my own house removed, and its place supplied with one of Gutta Percha Tubing. Nothing can be better. I have also recommended it to others, who have adopted the expedient."

A variety of Gutta Percha Articles, such as Mill Bands, Tubing, Sheet, Soles, Pump Buckets, Bosses, Union Joints, Bottles, Bowls, Flasks, Curtain and Cornice Rings, Solid Frames, Galvanic Batteries, &c., &c.

MANUFACTURED BY THE

Gutta Percha Company, Patentees,

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AND SOLD BY THEIR

WHOLESALE DEALERS IN TOWN AND COUNTRY.

(29)

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